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Research and application of microtechnologies in the Czech Republic

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1. INTRODUCTION

Since the invention of a microprocessor in 1971, the miniaturisation has progressively developed into real science and many application areas. The main driving force behind the miniaturisation of parts, facilities, systems, and their mass was their better reliability, lower manufacturing costs and prices. The main carriers of this development have been the silicon integrated circuits and the technologies for their packaging. Integrated circuits with their fantastically increasing complexity and density have become, for sure, the main motor of the miniaturisation, but they were the technologies of their packaging, which have allowed for their implementation. In the meantime, the density of integrated circuits, or the capacity of memory chips doubles every 18 months (Moore's law). With the progressing miniaturisation, many useful instruments have become mobile, e.g. the mobile telephones, television sets, computers, music players, etc. These instruments have become also cheaper, more intelligent, and more reliable at the same time. Similarly as with miniaturisation of electro-mechanical systems, a similar potential for the miniaturisation also exists in facilities transferring heat, or managing chemical reactions.

The miniaturisation made possible by the utilisation of microtechnologies is nowadays used in many industries, where the size and mass of products need to be decreased, while their reliability should increase and the use of energies and materials decrease. Applications of microproducts have already resulted, and they will result also in future, in important economic, environmental and other benefits in the industries like, for example, the production and the use of energies, transport, space technologies, chemistry, healthcare, protection of the environment, miniaturisation, information and telecommunications, defence and security, etc. A number of microtechnologies have been already utilised in practice, or they make the subjects of the applied research and development, while the miniaturisation progresses further towards its final size target – to nanometres. The basic research of nanotechnologies has already fully developed and the first applications have been already noted[1].

The countries, which dominate in the development and utilisation of microtechnologies today, are especially USA, Germany, and Japan. While USA focuses mostly on research and development of parts of micro-electromechanical systems (MEMS), equipment for the information technologies, and bio-medicine and genetic engineering, Germany dominates in sensor technologies for the automotive industry and Japan keeps its traditionally strong position in micro-processing, precise mechanics, in devices for the information technologies, and especially in consumer miniaturisation. Intensive applied research, development and application of microtechnologies take place also in Switzerland, United Kingdom, France, China, Taiwan, and Korea.

The situation existing in the Czech Republic will be described in this publication.

[1] Prnka, T., Šperlink, K.: "Nanotechnologie" (Nanotechnology), Repronis Ostrava, 2004, ISBN 80-7329-070-7

2. CHARACTERISTICS OF THE FIELD

2.1 DEFINITION AND TERMINOLOGY

Microtechnology presents the convergence of many technologies and disciplines – physics, chemistry, biotechnology, engineering, medicine, materials science, nanotechnologies, microminiaturisation, information technologies, etc. – which are utilised in structures, devices and systems, where their parts are within the size category of micrometers[2]. A microtechnology is also the ability to utilise synthetic means for the treatment of materials, facilities and systems within the size category of micrometers.
The current microtechnology has developed from electronics and from the precise mechanics by progressive miniaturisation. It was found in 1960s that the arrangement of a large number of microscopic transistors on one chip could create microelectronic circuits, which increase performance, functionality and reliability of electronic devices in a dramatic way, while their prices decrease and the lot manufacturing is made possible. The **microelectronics** have been thus born and developed**.** The result became the information revolution, which have brought to us the products like the Internet, personal computers, laptops and palmtops, mobile telephones, MP3 players, etc.
It has been found much later that it is useful and also possible to miniaturise not only electric devices, but the mechanical ones as well. While microelectronics could be considered the "brain" of advanced systems and products, micromechanical devices are utilised especially in sensors and actuators, which ensure the connection of devices with the outside world. Nowadays, **micromechanical devices** (micro machines) make key components in a large number of products, e.g. automotive air bags, blood pressure monitors, and projecting displays. Prognoses show that these devices will become as important in near future as the current electronic devices.
In 1980s the word **MEMS** – micro-electromechnical systems (or micro systems) occurred in the scientific literature. The word describes new sophisticated mechanical systems within a chip like, for example, electric micro engines, resonators, gearwheels, ratchet mechanisms, etc. The word MEMS is now used for any microscopic device with mechanical and electrical functions, which are placed on a chip and which allows for the lot manufacturing. The word thus does not relate, for example, to by a laser-treated stent or watch parts. The word MST – the microsystem technology, is often used in Europe instead of MEMS. MEMS are now utilised, for example, in automotive sensors or in ink printers. When an optical device is integrated within the system, it is MOEMS (the micro-opto-electromechanical system). This year, sales of MEMS at the level of about 12 billion euros are expected.
Without doubts, integrated circuits (microelectronics) could be considered the biggest success of the microtechnology. However, the microtechnology develops also in the area of **microchemical systems (MECS)** (the analytical systems, micro reactors, micro separators, heat exchangers, heat pumps, gas absorbers, etc.)[3], in **micro-biotechnologies** (e.g. bio-chips for the DNA analysis), in the construction of probe microscopes, and also in other fields. The microtechnology market should reach the value of 68 billion euros[4] worldwide in 2005.

In the meantime, together with the progressing miniaturisation of components and products, the size categories have been progressively made more precise as well. The sizes of small structure parts within the precise mechanics exist within the range of about 0.1 – 1mm. The scale from about 100nm to 100μm has been assigned to microtechnologies. The area below

[2] http://www.microtechnologycrc.com
[3] D.L. Brenchley: "Application for Micro Chemical and Thermal Systems", IMRET 5 Conference, 5/2001
[4] NEXUS Market Study 2002

100nm has become the domain of the emerging technology – the nanotechnology. However, the borders between these individual technologies have not been accurately defined.
The **micromachining** is considered one of the most important parts of the microtechnology. We talk here about classical methods of mechanical micromachining (milling, lathe-turning, planing, drilling, grounding, lapping, fine polishing, etc.) and about the non conventional methods like the electrochemical, laser, plasma, and other micro treatments. The word micromachining covers also the processes used in the manufacture of integrated circuits – the surface and bulk micromachining, photolithography, ion-implantation, dry and wet etching, electric-cladding, etc. Treatments and processing of materials are considered the micromachining, when they take place within the size range from about 1μm to about 2mm[5].

2.2 NOMENCLATURE

As the above-mentioned definition implies, the microtechnology means a very broad field and its nomenclature is thus very extensive as well. For example, the nomenclature of the big international microtechnology fair "MICRONORA", which takes place in the French City of Besançon every alternative year (the 16th Fair will take place in 2006), has been divided into two groups: a) Microtechnologies (192 items), b) Manufacturing equipment, instruments, products, and services (204 items)[6]. There are a number of other nomenclatures and classifications.
When activities of research and development workplaces and manufacturing plants are assessed, the following special division of the issues is used:

A – Semiconductors and parts for microelectronics
B - Communication microsystems
C - MEMS, MOEMS
D – Microscale technologies (mechanical micromachining, lithography, and chemical and other technologies)
E – Micro sensors
F – Manufacturing equipment for microtechnologies and their parts
G – Microanalytical equipment, its parts, and analytical methods
H – Microsystems for the use in biotechnology and medicine
I - Metrology
J - Microchemical systems
K - Microthermal systems
L - Materials for microtechnologies (particles, layers, composites, etc.)
M - Optics and optoelectronics
N – Other products of microtechnological equipment and the manufacture of devices (instruments, systems) with microtechnological parts or systems (e.g. computers, different instruments and devices, consumer electronics, etc.)

[5] M.Oettle: "High performance and precise treatment by miniature instruments", MM industrial spectrum, 3/2005, p. 60
[6] www.micronora.com

2.3 METHODOLOGY OF THE EXECUTED SURVEY

The word microtechnology has still not become common in the Czech Republic. The proof of that is, for example, the fact that the only scientific journal in this field, published in Czech by the Institute of Physics of the Academy of Sciences of the Czech Republic, has got the traditional title "Fine mechanics and optics" and the fields covered by the journal do not include any that would start with the prefix micro-.
When assessing the focus of individual research and development workplaces and manufacturing companies, there were activities considered, which could potentially serve the development or application of microtechnologies in different manufacturing industries. For example, there was the research of miniaturisation of analytical separation methods noted in the Institute of Analytical Chemistry of the Academy of Science of the Czech Republic, even if the size category of this miniaturisation was not mentioned. Another example is the manufacture of the precious metals' prefabricates in the company SAFINA because these metals are utilised in microproducts.
There were also the activities of companies manufacturing products, which include microtechnological components or even individual parts or materials belonging to the micrometre area, recorded in accordance with the mentioned definition. There were thus television sets, screens, TV and radio transmitters, computers, component manufacturers, and even manufacturers of automotive parts registered. The main reason behind that decision was the idea that the development of these industries in the Czech Republic can help, in the form of the market pressure, in focussing the domestic research on microtechnologies. This has been proved right by the establishment of development centres in the private sector. Unfortunately, this has happened mostly only thanks to foreign subjects.

3. REVIEW OF RESEARCH AND DEVELOPMENT ACTIVITIES

The executed survey showed that research and development in the area of microtechnology are in the focus of 9 institutes of the Academy of Sciences of the Czech Republic (AVČR or CAS), 10 university workplaces, and 10 research and development workplaces in the private sector. The applied research and development covering own needs are done in at least 20 large companies (with 250 or more employees) and in small and medium-size enterprises (SMEs).

3.1 LIST OF RESEARCH AND DEVELOPMENT ACADEMIC WORKPLACES

3.1.1 Institutes of the Academy of Science of the Czech Republic

Institute of Scientific Instruments of CAS
Královopolská 147, 612 64 Brno
http://www.isibrno.cz
Abbreviation: **ÚPT AVČR**

Institute of Radio Engineering and Electronics of CAS
Chaberská 57, 182 51 Praha 8
http://www.ure.cas.cz
Abbreviation: **ÚRE AVČR**

Institute of Physics of CAS
Na Slovance 2, 182 21 Praha 8
http://www.fzu.cz
Abbreviation: **FZÚ AVČR**

Institute of Analytical Chemistry of CAS
Veveří 97, 602 00 Brno
http://www.iach.cz/uiach
Abbreviation: **ÚanalCH AVČR**

Institute of Chemical Process Fundamentals of CAS
Rozvojová 135, 165 02 Praha 6
http://www.icpf.cas.cz
Abbreviation: **ÚCHP AVČR**

J. Heyrovsky Institute of Physical Chemistry of CAS
Dolejškova 3, 182 23 Praha 8
http://www.jh-inst.cas.cz
Abbreviation: **ÚMCHJH AVČR**

Institute of Plasma Physics of CAS
Za Slovankou 3, 182 00 Praha 8
http://www.ipp.cas.cz
Abbreviation: **ÚFP AVČR**

Institute of Macromolecular Chemistry of CAS
Heyrovského nám. 2, 162 06 Praha 6
http://www.imc.cas.cz
Abbreviation: ÚMCH AVČR

Institute of Biophysics of CAS
Královopolská 135, 612 65 Brno
www.ibp.cz
Abbreviation: **BFÚ AVČR**

3.1.2 University workplaces

Charles University, Faculty of Mathematics and Physics, School of Physics
Ke Karlovu 3, 121 16 Praha 2
http://www.mff.cuni.cz
Abbreviation: **UK-MFF**

Charles University, Faculty of Science, Section of Chemistry
Albertov 6, Praha 2
http://www.natur.cuni.cz
Abbreviation: **UK-PřF**

Masaryk University in Brno, Faculty of Science
Kotlářská 2, 611 37 Brno
http://www.sci.muni.cz
Abbreviation: **MU-PřF**

Czech Technical University, Faculty of Mechanical Engineering
Technická 4, 166 07 Praha 6
http://www.fs.cvut.cz
Abbreviation: **ČVUT-FS**

Czech Technical University, Faculty of Electrical Engineering
Technická 2, 166 27 Praha 6
http://www.fel.cvut.cz
Abbreviation: **ČVUT-FEL**

Czech Technical University, Faculty of Nuclear Sciences and Physical Engineering
Trojanova 13, 120 00 Praha 2
http://www.fjfi.cvut.cz
Abbreviation: **ČVUT:FJFI**

Brno University of Technology, Faculty of Mechanical Engineering
Technická 2. 616 69 Brno
http://www.fme.vutbr.cz
Abbreviation: **VUT-FSI**

Brno University of Technology, Faculty of Chemistry
Purkyňova 118, 612 00 Brno
http://www.fch.vutbr.cz
Abbreviation: **VUT-FCH**

Brno University of Technology, Faculty of Electrical Engineering and Communication
Údolní 244/53, 602 00 Brno
http://www.feec.vutbr.cz
Abbreviation: **VUT-FEKT**

Palacky University, Faculty of Science
Křížkovského 8, 771 47 Olomouc
http://www.upol.cz
Abbreviation: **UPOL**

University of Pardubice, Faculty of Chemical Technology
Čs.legií 565, 532 10 Pardubice
http://www.upce.cz
Abbreviation: **UPCE**

Institute of Chemical Technology, Faculty of Chemical Technology
Technická 5, 166 28 Praha 6
http://www.vscht.cz
Abbreviation: **VŠCHT-FCHT**

Institute of Chemical Technology, Faculty of Chemical Engineering
Technická 5, 166 28 Praha 6
http://www.vscht.cz
Abbreviation: **VŠCHT-FCHI**

Technical University of Liberec, Faculty of Mechatronics
Hálkova 6, 461 17 Liberec
http://www.vslib.cz
Abbreviation: **TUL-FMM**

Technical University of Liberec, Faculty of Mechanical Engineering
Hálkova 6, 461 17 Liberec
http://www.vslib.cz
Abbreviation: **TUL-FS**

University of West Bohemia, Faculty of Applied Sciences
Univerzitní 22, 306 14 Plzeň
http://www.fav.zcu.cz
Abbreviation: **ZČU-FAV**

University of West Bohemia, Faculty of Electrical Engineering
Univerzitní 26, 306 14 Plzeň
http://www.fel.zcu.cz
Abbreviation: **ZČU-FEL**

Jan Evangelista Purkyně University, Institute of Science
České mládeže 8, 400 96 Ústí nad Labem
http://sci.ujep.cz
Abbreviation: **UJEP**

3.2 REVIEW OF ACTIVITIES BY ACADEMIC WORKPLACES, ACCORDING TO THE CODES

Code A – Semiconductors and parts for microelectronics

The following institutes of the Academy of Sciences of the Czech Republic and university faculties implement research activities in this field:
ÚRE AVČR, FZÚ AVČR, UK-MFF, MU-PřF, ČVUT-FEL, VUT-FEKT, VŠCHT-FCHT, TUL-FMM, and ZČU-FEL.
The attention in the research of semiconductors focuses mostly on properties and modern ways of preparation of semiconductor layers of the AIIIBV – GaAs and GaSb kind for the utilisation in optical electronics (ÚRE AVČR) and electronics (FZÚ AVČR) and on semiconductor properties of the AIIBVI – CdTe kind (UK-MFF). FZÚ AVČR focuses also on the research of preparation ways and properties of the amorphous hydrogenated Si (a-Si:H), microcrystalline hydrogenated Si (μ-Si:H), and the porous Si for the use in photovoltaics. Another workplace is involved (no details are available) in the semiconductor physics (the study of defects, etc. – ČVUT-FEL), in the technology for the preparation of thin semiconductor layers, and in the study of their properties and the research of the multilayer metal-semiconductor-insulators (MU-PřF).

The workplaces focus, in the area of parts for microelectronics, on the design of integrated circuits (VUT-FEKT, TUL-FMM), the development of integrated optics on semiconductors (VŠCHT-FCHT), and, at ZČU-FEL, they develop facilities with single chip computers.
The biggest research capacity related to semiconductors is undertaken at FZÚ AVČR.

Code B – Communication microsystems

The research activities within this area have been registered only at ČVUT-FEL, where a small group involved in microsystems, in the Department of microelectronics, deals with the processing of sensor signals and with the wireless data transfer.

Code C – MEMS, MOEMS

Despite the fact that micro-electromechanical systems make the subject of extensive research and development in a number of countries (especially in USA, Japan, Germany, France, United Kingdom, etc.), the Czech research basically ignores this field. Only the Faculty of mechatronics at the Technical University in Liberec (TUL-FMM), the Department of electrotechnology, deals with the basic research of selective circuits by the electromechanical conversion of signals.

Code D – Microscale technology

Research activities in this field have been undertaken by the following institutes of the Academy of Sciences of the Czech Republic and by the following university faculties:
ÚPT AVČR, FZÚ AVČR, UK-PřF, ČVUT-FS, ČVUT-FEL, VUT-FSI, VUT-FCH, VŠCHT-FCHT, and ZČU-FAV.
The Czech workplaces undertake research and development of many varied preparation technologies and the technologies for the microscale treatment of materials – especially of layers and multilayers on different surfaces and the micromachining. However, the following list is not complete because we have not received detailed information from some of the workplaces.
Preparation of thin inorganic layers:

- Magnetron sputtering (ÚPT AVČR, ZČU-FAV)
- Molecular beam epitaxial method - MBE and by the method MOVPE (FZÚ AVČR)
- Laser depositing (FZÚ AVČR, VŠCHT-FCHT)
- Direct depositing of the focussed ion beam (VUT-FSI)
- Plasma technologies (ZČU-FAV)
- Sol-gel methods (UK-PřF)

Preparation of thin layers of organic materials:

- Plasma depositing of polymer layers (VUT-FCH)
- Plasma layer polymerisation (VUT-FCH, MU-PřF)
- Sol-gel methods (VUT-FCH)

Lithographic methods:

- Micro lithography for different purposes – the diffractive optical components, holography (ÚPT AVČR)
- Lithography during the preparation of semiconductor structures (FZÚ AVČR)

Single crystal growing:

- New monocrystalline preparation methods for semiconductor compounds (ČVUT-FEL)

Micromachining by:

- Laser and chip micromachining technologies (ČVUT-FS)

Optical tweezers:

- Development of optical tweezers for the micro scale handling (ÚPT AVČR).

Code E – Microsensors

Research and development of sensors for different purposes is currently quite popular in the Czech Republic. There were 12 institutes of the Academy of Sciences of the Czech Republic and university faculties identified, the workplaces of which are involved in this field. They are as follows:

- ÚPT AVČR, ÚRE AVČR, ÚMCH AVČR, BFÚ AVČR, UK-MFF, MU-PřF, ČVUT-FS, ČVUT-FEL, VUT-FEKT, VŠCHT-FCHT, VŠCHT-FCHI, TU-FMM, and UJEP.
- Different kinds of chemical sensors are developed in BFÚ AVČR (biochemical sensors), VUT-FEKT, VŠCHT-FCHI (thermocatalytic – pellistor sensors), and UK-PřF (electrochemical sensors).
- Detectors of the ion radiation are developed in ÚPT AVČR, ČVUT-FS, and UK-MFF (gas sensors).
- Pyroelectric sensors are researched in ÚRE AVČR (for the gas detection, in co-operation with Tesla Blatná), ČVUT-FEL, and ÚMCH AVČR.
- Piezoelectric sensors are developed at MU-PřF (bio-sensors) and TUL-FMM.
- Humidity detectors are developed at UK-MFF
- Pressure sensors are developed at ČVUT-FEL
- Optical (bio)sensors are researched in ÚRE AVČR, ÚMCH AVČR, UJEP, VUT-FEKT, ČVUT-FEL, and VŠCHT-FCHI.
- The most extensive research and development activities in this field have been registered in ÚRE AVČR and VŠCHT-FCHI.

Code F – Manufacturing equipment for microtechnologies and their parts

Only one institute of the Academy of Sciences of the Czech Republic and VUT – Faculty of electrotechnology and communication technologies are involved in the development of manufacturing equipment for the area of microtechnologies.

- Parts for micro lithographic systems are developed in ÚPT AVČR.
- Probes for the probe microscopes are manufactured at VUT-FEKT.

Code G – Microanalytical equipment, its parts, and methods

Three workplaces in institutes of the Academy of Science of the Czech Republic and 3 workplaces at university faculties undertake the development of microanalytical equipment and microanalytical methods. They are as follows: ÚPT AVČR, FZÚ AVČR, ÚanalCH AVČR, VUT-FSI, VUT-FEKT, and VŠCHT-FCHT.

ÚPT AVČR undertakes the development of:

- Ultra high vacuum microscope SLEEM
- Low voltage transmission microscope
- Optical tweezers and optical scalpel
- Environmental microscope.

- FZÚ AVČR undertakes the development of new laser kinds.
- ÚanalCH AVČR deals with the development of different bio-analytical instruments.
- VUT-FSI develops:
- Ultra vacuum facility for the direct depositing of ultra thin layers focussed by ion beam
- In-situ analysis of surfaces and deposited layers
- Microanalytical equipment for the spectroscopy of secondary ions (SIMS)
- Spectroscopy of photoelectrons excited by roentgen radiation (XPS)
- Surface microscopy by the method (STM/AFM) in the ultra vacuum environment.

VUT-FEKT deals with the research of methods for the utilisation of electron beams in material diagnostics.
VŠCHT-FCHT undertakes the development of application methods for the electron microscopy and of microanalytical methods for the assessment of inorganic materials and the solid compounds' surface analysis.

Code H - Microsystems used in biotechnology and medicine

Four workplaces of the Academy of Sciences of the Czech Republic and 7 workplaces of university faculties undertake research and development in this field. They are as follows: ÚPT AVČR, Úanal.CH AVČR, ÚMCH AVČR, BFÚ AVČR, MU-PřF, ČVUT-FS, ČVUT-FEL, VUT-FCH, VUT-FEKT, ZČU-FEL, and UJEP. The undertaken research could be called the mixed one.
ÚPT AVČR focuses on the development of an optical scalpel, the construction of instruments for the micro neurosurgery, and the development of instruments for the cardiovascular diagnostics.
Úanal.CH AVČR researches different separation methods like those used, for example, in a single cell analysis.
ÚMCH AVČR undertakes:

- Research of polymer systems for the gene therapy
- Research of polymer systems for the targeted delivery of drugs
- Development of hydro-gels for the managed releases of drugs
- Research in the field of micro- and nano-biotechnology for the preparation of biological interfaces – the preparation of nanostructured molecular sets by the consequent depositing of biological and synthetic macromolecules on synthetic polymer bases and the study of set creation and their properties by the methods of multiple reflective infrared spectroscopy (FTIR, MIRS), surface plasmons resonance (SPR) and AFM in water environment. Specific sets consisting of proteins, polysaccharides and polypeptides are used as biological affinity layers in optical bio-sensors and separation media as the surface layers, which are tolerated by blood and healthcare means and as the surface layers for the cell growth on support polymer structures in the tissue engineering.

The laboratory of bio-macromolecules and their parts in BFÚ AVČR focuses on:

- Research of electrodes: Preparation of fixed electrodes and their modification - Metallic, graphite/carbonaceous and semiconductor materials, mercury film electrodes, amalgam alloys, electrodes modified in a chemical way or by nanoparticles and bio-polymers
- Physical-chemical properties of prepared electrodes. They are studied by electrochemical and optical methods and with the analysis of the surface morphology

- Creation of condensed films and the study of dynamics in two-dimensional condensed films (self-assembled layers) in parts of nucleic acids (bases, nucleosomes and nucleotides) on mercury, mercury-film, amalgam, and solid metallic electrodes
- Sensitive voltammetric detection of nucleic acids and synthetic oligo-nucleotides on chemically modified surfaces
- Study of the morphology and conforming changes in nucleic acids, oligo-nucleotides and proteins on solid electrodes chemically modified by electrochemical (voltammetry, electrochemical impedance spectroscopy) and optical methods
- Development of bio-sensors (especially of the electrochemical ones) detecting the hybridisation of DNA on modified surfaces.

The Department of biochemistry at MU-PřF is involved in:

- Research done in the field of metabolism regulation in microorganisms, animals and plants and in the field of bio-analytical chemistry
- Bio-sensors: Development of electrochemical and piezoelectric bio-sensors, the applications of enzymatic electrodes and immunologic sensors in the environment and in the clinical area, the study of affinity interactions in real time with the help of bio-sensors
- Bio-molecule separation methods by the utilisation of modern separation methods – the high performance liquid chromatography (HPLC) and the capillary electrophoresis (CE) in the qualitative and quantitative analyses of biologically active low-molecular and high-molecular compounds (medicinal herbs, clinical diagnostics, enzymes, etc.).

ČVUT-FS, the Institute of Mechanics – the Independent laboratory for the human biomechanics, undertakes research and development in the field of bio-medical engineering as follows:

- Bio-mechanics of the muscle-skeleton system and its replacements
- Bio-mechanics of the cardiovascular system and its replacements
- Research of tissues and organ structures
- Bio-material engineering.
- The attention in this field is paid to the utilisation of new materials for the construction of implants, e.g. bio-ceramics, in the case of total knee joint replacements, or the C-C composites, in the case of inter-vertebrae spacers, and the utilisation of new surface layers for the improvement of implant properties.

ČVUT-FEL develops a bio-mimetic nanoactuator – the artificial muscle.
Research in the field of microbiological systems and technologies is undertaken at VUT-FEKT.
ZČU-FEL researches and develops electric devices for the medical use.
At UJEP, they undertake the study of the managed immobilisation of bio-molecules, the self-assembly and the development of bio-sensors.

Code I – Metrology

Metrology issues in the area of microtechnologies are researched by the three following workplaces in institutes of the Academy of Sciences of the Czech Republic and the four following workplaces at university faculties: ÚPT AVČR, ÚRE AVČR, FZÚ AVČR, ČVUT-FS, VUT-FSI, TUL-FMM, and ZČU-FEL.
ÚPT AVČR conducts the development of laser length standards and optical frequency etalons.
ÚRE AVČR deals with the time and frequency measuring.
FZÚ AVČR develops different optical measuring methods.
ČVUT-FS deals with the engineering metrology and the diagnostics of machined surfaces.

VUT-FSI is involved in the classical and holographic interferometry.
TUL-FMM, the Department of measuring, conducts: The measuring of electric and non-electric values, the development of analogue and digital measuring instruments, automated measuring systems and it uses the following optical measuring methods - laser anemometry, visualisation, interferometry, and computer image processing.
ZČU-FEL organises the development of special measuring technology in the direct and low-frequency areas and the development of software for measuring systems.

Code J – Microchemical systems

Research in the field of microchemical systems was registered only in the Jaroslav Heyrovský Institute of Physical Chemistry of the Academy of Sciences of the Czech Republic and at the Jan Evangelista Purkyně University in Ústí nad Labem. However, we might consider chemical and biochemical micro sensors and some micro systems, suitable for the use in bio-technologies and in medicine (see the Codes E and H), the microchemical systems as well.
ÚFCHJH AVČR conducts research of the synthesis of microporous catalytic systems.
UJEP organises, inter alia, the development of a new technology related to electrochemical microchips.

Code K – Micro thermal systems

No research has been registered in this field.

Code L – Materials for microtechnologies

Research of different material properties and the development of new materials have belonged among the interests of a large majority of the identified workplaces. This review includes the workplaces, which conduct the material research, the results of which could be potentially or directly utilised within microtechnologies, in fabrications of parts, facilities, and systems.
Out of the nine assessed institutes of the Academy of Sciences of the Czech Republic, materials for microtechnologies are not researched only in ÚAnalCH AVČR and BFÚ AVČR. Out of 19 assessed university faculties, materials for microtechnologies are not researched only at ČVUT-FJFI and VŠCHT-FCHI. The research takes place in the areas of metals, ceramics and glass, semiconductors, inorganic materials, carbon, polymers, biological, and other special material kinds. There are materials researched and developed in the form of layers, films, particles, and also bulk materials. Individual workplaces conduct research of different intensity and within different scopes. The level of the material research depends very much on the infrastructure (the instrument equipment, experimental and semi-production equipment). The level of the research infrastructure differs in individual workplaces very much because purchases of often costly equipment are not coordinated. Especially at universities, there are only small teams involved in the individual material fields. The situation, according to the individual material kinds, is as follows (Note: Neither the material research division, nor the listing is complete):

Research of metals: FZÚ AVČR, UK-MFF, MU-PřF, ČVUT-FS, and VUT-FSI,
Research of ceramics and glass: ÚRE AVČR, FZÚ AVČR, ÚFCHJH AVČR (zeolites), ÚFP AVČR, ÚMCH AVČR, UPCE, MU-PřF, ČVUT-FS, VUT-FSI, UPOL, VŠCHT-FCHT, TUL-FMM, and TUL-FS,
Research of semiconductors and silicon: ÚRE AVČR, FZÚ AVČR, UK-MFF, MU-PřF, ČVUT-FEL, VŠCHT-FCHT, TUL-FMM, ZČU-FEL, and ÚCHP AVČR,

Research of inorganic materials: ÚRE AVČR, ÚFCHJH AVČR, UPCE, and VUT-FCHT,
Research of carbon (diamond): FZÚ AVČR, UK-MFF, MU-PřF, and ČVUT-FEL,
Research of polymers: ÚCHP AVČR, ÚMCH AVČR, UK-MFF, MU-PřF, ČVUT-FS, VUT-FCH, VŠCHT-FCHT, and TUL-FMM,
Research of biologically active materials: ÚMCH AVČR, BFÚ AVČR, MU-PřF, ČVUT-FS, ČVUT-FEL, VUT-FCH, and UJEP,
Research and deposition of layers: FZÚ AVČR, ÚCHP AVČR, ÚFP AVČR, ÚMCH AVČR, UK-MFF, UK-PřF, MU-PřF, ČVUT-FS, VUT-FSI, VUT-FCH, TUL-FS, ZČU-FAV, and UJEP.

Special materials:
Liquid crystals: FZÚ AVČR and UK-MFF,
Ferroelectrics: FZÚ AVČR,
Dielectrics: FZÚ AVČR and ČVUT-FEL,
Magnetic materials: FZÚ AVČR, UK-MFF, UK-PřF, and VŠCHT-FCHT,
Superconductors: FZÚ AVČR, MU-PřF, and VŠCHT-FCHT,
Photonic materials: ÚMCH AVČR,
Materials for batteries: VUT-FEKT,
Supercondensers: VUT-FEKT,
Thermoelectric materials: VŠCHT-FCHT and UPCE.

Code M – Optics and optoelectronics

There are 3 workplaces in institutes of the Academy of Sciences of the Czech Republic and 8 workplaces at university faculties involved in the research of optics and optoelectronics. They are as follows: ÚRE AVČR, FZÚ AVČR, ÚMCH AVČR, UK-PřF, ČVUT-FS, ČVUT-FEL, ČVUT-FJFI, VUT-FSI, UPCE, VŠCHT-FCHT, and TUL-FMM.

ÚRE AVČR: Research in the section of photonics is focussed on photonic materials, structures and facilities for the optical communications, and on sensors. The main research directions are as follows: Controlled wave photonics, material research of fibre optics, diffractive optical research, and the research of optical sensors. The section consists of the three following departments: The Department of wave photonics, the Department of optical sensors, and the Department of the optical fibres technology.
FZÚ AVČR: Within the section of optics, activities are undertaken by the Department of multilayer structures, the Department of applied optics and optics (the joint workplace with the Palacký University in Olomouc). The Department of multilayer structures conducts research of the deposition of thin layers in low-pressure systems under the atmospheric pressure, laser deposition and the study of thin layers for optics, engineering, and medicine, ellipsometric measurements of solid compounds' properties, etc. The Department of applied optics deals with the roentgen crystalline optics for the synchrotron radiation, the study of thin layer system properties with optical methods, the design and manufacture of optical parts and sets for the visible, UV, and IR areas of radiation, and with the development of optical measuring methods.
ÚMCH AVČR: The Department of the chemistry of solid materials, placed at the University in Pardubice – the Joint laboratory of solid compounds of ÚMCH AV ČR and the University Pardubice, the Group of non crystalline materials, researches the ways of preparation of highly pure glass consisting of elements (S, Se, Te, I, Br) + (P, As, Sb, Ge, Bi, and transitional elements), or their combinations. It studies their optical properties, crystallisation and physical aging. There are passive elements developed for the IR area and sensors,

protective and antireflection layers, and memory media both for the reversible and irreversible storage of information.
UK-PřF: There is the research of non linear optical materials with the hydrogen bond conducted.
ČVUT-FS: Research and development of optical instruments and systems.
ČVUT-FEL: The Group of optoelectronics in the Department of microelectronics conducts the following research activities: Preparation and measuring of properties of planar waveguides, the preparation of which is based on the utilisation of different deposition and diffusional techniques, the analysis, preparation and measuring of properties of new planar electro-optical structures for the distribution and controls of optical radiation, the research of solutions of integrated optical circuits for the communication, measuring, and sensor applications.
ČVUT-FJFI: There are the research and development of laser systems conducted, including their applications.
VUT-FSI: The research activities in the Institute of Physical Engineering, the Department of optics and precise mechanics, are focussed on optical tomography, optical diffraction, and the optical image processing.
UPCE: The Department of general and inorganic chemistry conducts research focussed on the study of chalcogenide, chalcogenide-haloid and haloid glass and amorphous layers. They study the possibility of their application in the creation of sub micron diffraction elements for the visible and infrared areas. There is also research of non silicate oxide glass organised as well as the preparation of new kinds of borophosphate, phosphate, boron, and tellurium glasses, the establishment of their basic physical parameters, the study of properties and optical properties of these glasses, and the study of their structures by spectroscopic methods. The objective is also the finding of relations between the consistency, structure and properties of the described glasses.
VŠCHT-FCHT: There are the preparation and studies of properties of planar optical waveguides organised.
TUL-FMM: The Department of measuring develops optical measuring methods - laser anemometry, visualisation, interferometry, computer image processing, and the research in the area of photonics.

Code N – Manufacture of devices and parts

Academic workplaces do not participate in manufacturing. In none of the academic workplaces they have had conditions so far for the establishment of a spin-off kind enterprise.

3.3 RESEARCH AND DEVELOPMENT WORKPLACES IN THE PRIVATE SECTOR

S3 – Silicon & Software Systems Česká republika, s.r.o.
Šafránkova 1, 155 00 Praha 5
www.s3group.com

This is a subsidiary of Silicon & Software Systems Ltd., Ireland, focussed on the development of chips for communication systems and digital technology. The enterprise was founded in 2000 and there are about 100 workers employed in it.
Codes: A, B

SCG Czech Design Center, s.r.o.

Boženy Němcové 1720, 756 61 Rožnov pod Radhoštěm
http://www.tese.cz/scg

The development centre CDC is a part of the multinational company ON Semiconductor. It was founded in 1994 as a development workplace of the Motorola Company. It participates in the area of design of integrated circuits and deals with the design of analogue integrated circuits utilising bipolar, BiCMOS, VHV, and CMOS technologies, the development of testing of integrated circuits and their properties, the development of libraries for the design of integrated circuits, and the characterisation of technological processes and their simulations.
The second important part of the CDC activities is made of the internal development of software, mainly the software supporting the manufacture of semiconductors – the automation of manufacturing processes, management of technological facilities, database applications, and intranet solutions. It participates also in the development of e-business solutions and in the support of manufacturing plants in the region of Central Europe - the implementation and operations of standard management systems and production planning.
Codes: A, B

Flextronics Design, s.r.o.

Areál Slatina, Tuřanka 115, 627 32 Brno
http://www.flextronics.com/Contacts/GlobalLocations/Brno.asp

When Flextronics finished its activities in the Czech Republic in 2003, a development centre with 45 workers remained in Brno. They develop complex integrated circuits.
Code: A

Freescale Polovodiče Česká republika, s.r.o.

1. máje 1009, 756 61 Rožnov pod Radhoštěm
www.freescale.com

It is a systemic application laboratory of Freescale Semiconductor Inc., USA, which is fully owned by Motorola Inc. The laboratory was founded in 1999 and it employs 40 workers. There is the development and prototype manufacturing of sample technological solutions, involving semiconductor parts, organised especially for the automotive industry and consumer electronics.
Code: A

AMI Semiconductor Czech, s.r.o.

Vídeňská 125, 619 00 Brno
http://www.amis.com

The development centre of the American company AMI Semiconductor was founded in 1996 and it currently employs about 50 workers, who are involved in the development of custom-made integrated circuits (ASIC), mostly for the mixing of digital and analogue signals.
Code: A

STMicrominiaturisation

Pobřežní 3, 186 00 Praha 8
http://www.st.com

STMicrominiaturisation NV is one of the leading world development and manufacturing companies active in the area of semiconductors and microelectronics. It has operated its development centre (ID Design Factory) in Praha since 2003. The number of employees increases fast and should reach 250 workers in 2005. Development activities are focussed on high performance linear circuits and products for the automotive industry.
Code: A

MicroTek, s.r.o.

Pod vodovodem 3, 158 00 Praha 5
www.microtek.cz

This enterprise organises research, development, and manufacture of custom-made hybrid integrated circuits and microwave parts designed on ceramic and plastic bases of photolithographs and microgalvanics. The company was founded in 1993 by the privatisation of the former division of microwave parts belonging to the state owned company Tesla VÚST. Number of employees: About 20.
Codes: A, D

ASICentrum, s.r.o.

Novodvorská 994, 142 21 Praha 4
www.asicentrum.cz

The enterprise is involved in the development and implementation of custom-made integrated circuits (CMOS, RFID, etc.). It was founded in 1992 and there are about 40 workers employed in it. Some shares of the company have been owned, since 2001, by EM Microelectronic, Switzerland, which belongs to the Swatch Group.
Code: A

SVM microwaves, s.r.o.

U Mrázovky 5, 150 00 Praha 5
www.svm.cz

The company makes the research-development base for the support of enterprises active in the field of data transfers and the transfer of radio and TV signals. It was founded in 1994. The company focuses mostly on the development and manufacture of highly advanced and unique electronic devices like, for example, the microwave radio-relay connections, microwave television signal distribution systems, multipoint systems for the distribution of the Internet, etc.
Code: B

e4t miniaturisation for transportation, s.r.o.

Novodvorská 994, 14221 Praha 4
www.e4t.cz

The company, founded in 2001, organises research and development in the area of telematics in cars, data support for the testing portals, the management, simulation, and mechatronics. It is involved also in the analyses of new systems and services for the automotive industry. This

company is a joint venture of Czech Süddeutschland, s.r.o. and ŠKODA AUTO, a.s. from Mladá Boleslav. It employs about 40 people.
Codes: B, E

4. MANUFACTURING COMPANIES

This part of the report characterises companies involved mostly in the manufacture of materials and components for microtechnologies, the manufacture of microtechnological equipment and instruments, which include microtechnological parts or microsystems. In some cases, these enterprises conduct also their own research and development. The consumers of products by the mentioned companies are mainly domestic and foreign car and aircraft makers and consumer electronics, computer, and communication technology manufacturers.
The companies have been divided into two following groups: The large companies with 250 or more employees and SME (small and medium-size enterprises) with fewer than 250 employees. Activities of each company are characterised with the code, according to Part 2.2. Companies in each part are alphabetically ordered.

4.1 LARGE ENTERPRISES

Name	AEG components, s.r.o.
Address	Průmyslová 1110, 506 01 Jičín
URL	www.awg-components.cz
Number of workers, Year of founding	300, founded in 1998
Activity	Manufacture of consumer motor capacitors and condensers for fluorescent lights
Status	100% subsidiary of AEG KuW, GmbH, Germany
Code	A

Name	ALPS Electric Czech, s.r.o.
Address	Dřevařská 17, 680 01 Boskovice
URL	www.alps.cz
Number of workers, Year of founding	400, founded in 1995
Activity	Mass manufacture of keyboards, RF modulators, TV tuners, and satellite converters (LNB)
Status	100 % subsidiary of ALPS ELECTRIC Co, Japan
Code	N

Name	ASUS Czech, s.r.o.
Address	Rudná u Prahy, 252 19 K Vypichu 979
URL	www.asus.com
Number of workers, Year of founding	200-249, founded in 2002

Activity	Manufacture of electronic equipment
Status	100% subsidiary of Asus Holland Holding B.V., Netherlands
Code	N

Name	ASUSTek COMPUTER
Address	Ostrava-Hrabová
URL	www.asus.com
Number of workers, Year of founding	About 1000, founded in 2004
Activity	Manufacture of computers, the repair centre
Status	Subsidiary of Asus Holland Holding B.V., Netherlands
Code	N

Name	AVX Czech Republic, s.r.o.
Address	Dvořákova 328, 563 01 Lanškroun
URL	www.avxcorp.com
Number of workers, Year of founding	3600, founded in 1992
Activity	Manufacture of tantalic chip condensers and layered ceramic condensers
Status	100% subsidiary of AVX Limited, United Kingdom
Code	A

Name	BRISK Tábor, a.s.
Address	Vožická 2068, 390 02 Tábor
URL	www.brisk.cz
Number of workers, Year of founding	850, founded in 1992/1935
Activity	Manufacture of spark and glow plugs, the manufacture of sensors (contactless inductive revolution counters, level gauges), and technical ceramics
Status	Czech company
Code	E, L

Name	Celestica Kladno, s.r.o.
Address	Billundská 3111, 272 01 Kladno
URL	www.celestica.com
Number of workers, Year of founding	More than 500, founded in 1998/2001
Activity	PCB assembly
Status	100% subsidiary of Celestica European Holdings S.ar.l., Luxembourg
Code	N

Name	Celestica Ráječko, s.r.o.
Address	Ulice Osvobození 363, 679 02 Ráječko
URL	www.celestica.com

Number of workers, Year of founding	1800, founded in 1999
Activity	PCB assembly, systems and memories
Status	100% subsidiary of Celestica European Holdings S.ar.l., Luxembourg
Code	N

Name	Connaught Miniaturisation /CZ/, spol. s r.o.
Address	Jiřice u Humpolce
URL	www.cel-europe.com
Number of workers, Year of founding	300, founded in 2004
Activity	Manufacture of sensors
Status	100% subsidiary of Connaught Miniaturisation, Ireland
Code	E

Name	EPIQ CZ, s.r.o.
Address	Americká 124, 330 11 Třemošná u Plzně
URL	www.epiq.com
Number of workers, Year of founding	550, founded in 1991
Activity	Assembly and manufacture of PCBs (printed circuit boards)
Status	100% subsidiary of EPIQ NV, Belgium
Code	N

Name	ELTES CZ, s.r.o.
Address	Nádražní 206, 561 64 Jablonné nad Orlicí
URL	www.eltes-cz.cz
Number of workers, Year of founding	400, founded in 1999/1994/1929
Activity	Manufacture of passive electric components (wire and regulatory resistors, potentiometers, etc.)
Status	Czech company
Code	A

Name	EPCOS,s.r.o.,
Address	Feritová 1, 787 15 Šumperk
URL	www.epcos.com
Number of workers, Year of founding	615, founded in 1999
Activity	Manufacture of passive electronic parts made of ferrites
Status	Subsidiary of the EPCOS Holding (the joint venture of Siemens and Matsushita founded in 1989)
Code	A, L

Name	FIC CZ, s.r.o.
Address	K Vypichu 1138, 252 19 Rudná
URL	www.fic.cz
Number of workers, Year of founding	370, founded in 1991
Activity	Manufacture of motherboards (PCB-printed circuit boards), graphic cards, and the assembly of PC systems
Status	100% subsidiary of FIC FIRST International Holding B.V., Netherlands
Code,	N

Name	Foxconn CZ, s.r.o.
Address	U Zámečku 26, 532 01 Pardubice
URL	www.foxconn.cz
Number of workers, Year of founding	2100, founded in 2000
Activity	Manufacture of electronic products, computers, and motherboards
Status	100% subsidiary of Foxconn Holdings B.V., Netherlands (Foxconn is the trade mark of the Taiwanese company Han Hai Precision Industry, Co. Ltd., which is the 100% owner of Foxconn Holdings)
Code	N

Name	Cherry, spol. s r.o.
Address	Osvobozená 780, 431 51 Klášterec nad Ohří
URL	www.cherry.cz
Number of workers, Year of founding	550, founded in 1993
Activity	Manufacture of sensors (speed sensors, acceleration meters, spark sensors) and switches
Status	100% subsidiary of Cherry GmbH, Germany
Code,	E

Name	Infineon Technologies, s.r.o.
Address	Volanovská 518, 541 01 Trutnov
URL	www.infineon.cz
Number of workers, Year of founding	750, founded in 2000
Activity	Manufacture of optical-fibre wave guides and connectors, optoelectronic exchangers and discrete optoelectronic parts (laser and receiver diodes)
Status	100% subsidiary of Infineon Technologies BV., Netherlands
Code	M

Name	L.G. Philips Displays Czech Republic, s.r.o.
Address	Tovární 605, 753 01 Hranice
URL	www.philips-displays.com
Number of	About 1500, founded in 2001

workers, Year of founding	
Activity	Manufacture of electronic parts for the manufacture of screens and activities of a development centre
Status	100% subsidiary of L.G. Philips Displays Investment B.V. Philips, Netherlands
Code	N

Name	Panasonic Mobile & Automotive Systems Czech, s.r.o.
Address	Pardubice, Staré Čívice, U Panasonicu 266, Post Code 53006
URL	www.panasonic.cz
Number of workers, Year of founding	550, founded in 2001
Activity	Manufacture of mobile phones and car radio sets
Status	Panasonic Mobile Communications Co. Ltd. (30%), Japan, Matsushita Electric Industrial Co. Ltd. (70%)
Code	N

Name	METRA Blansko, a.s.
Address	Poříčí 24, 678 49 Blansko
URL	www.metra.cz
Number of workers, Year of founding	1480, founded in 1911/1990
Activity	Manufacture of electric and electronic measuring instruments and equipment
Status	Czech company
Code	I, N

Name	ON SEMICONDUCTOR CZECH REPUBLIC, a.s. (ONCR)
Address	1. máje 2230, 756 61 Rožnov pod Radhoštěm
URL	www.onsemi.cz
Number of workers, Year of founding	1400, in 1999 (ON Semiconductor took over the manufacture of semiconductor parts from Motorola), in 2003 (the fusion of ON Semiconductor, Terosil, and Tesla Sezam into ONCR)
Activity	Manufacture of monocrystalline silicon, manufacture of polished silicon wafers for microelectronics, manufacture of silicon wafers with an epitaxial layer, and the design and manufacture of semiconductor parts. Research and development of silicon wafers, analogue semiconductor parts and semiconductor detectors.
Status	100% subsidiary of the globally active concern ON Semiconductor. One of the eight manufacturing plants of the concern.
Code	A, E, L

Name	OPTREX Czech, a.s.
Address	Bucharova 194, 543 02 Vrchlabí
URL	www.optrex.cz
Number of	700, founded in 1996

workers, Year of founding	
Activity	Manufacture of LCD displays
Status	100% subsidiary of OPTREX EUROPE GmbH, Germany
Code	A

Name	Panasonic AVC Networks, s.r.o.
Address	U Panasoniku 1, 320 84 Plzeň-město
URL	www.matsushita.cz
Number of workers, Year of founding	1850, founded in 1996
Activity	Manufacture of colour television sets, activities of the research-development centre in the field of modern television parts, software, and design
Status	100% subsidiary of PANASONIC EUROPE LTD., United Kingdom
Code	N, A

Name	Polovodiče, a.s.
Address	Novodvorská 138a, 142 21 Praha 4
URL	www.polovodice.cz
Number of workers, Year of founding	250, founded in 1963/1994
Activity	Development and manufacture of semiconductor parts, Si monocrystals and wafers, electronic applications, and roentgen monochromators
Status	Czech company
Code	A, L, N

Name	SAFINA, a.s.
Address	Vídeňská 104, 252 42 Jesenice, Vestec
URL	www.safina.cz
Number of workers, Year of founding	320, founded in 1950/1992
Activity	Manufacture of prefabricates and chemicals containing precious metals, reprocessing of precious metals: materials of Ag and its alloys, silver anodes, connections for electrotechnology, Ag and Pt targets, products of palladium, platinum, platinum alloys, rhodium, gold, etc.
Status	Czech company
Code	L

Name	Saint-Gobain-Advanced Ceramics, s.r.o.
Address	Přepeřská 1302, 511 01 Turnov
URL	www.sgac-turnov.cz
Number of workers, Year of founding	320, founded in 1999

Activity	Research, development, and the manufacture of special ceramics for cutting tools, electro-ceramics and high-tech products
Status	100% subsidiary of the Saint Gobain Ceramiques Avancees Desmarquest Group, France
Code	L

Name	Siemens VDO Czech Republic, s.r.o.
Address	Průmyslová 1851, 250 01 Brandýs nad Labem
URL	www.siemensvdo.com
Number of workers, Year of founding	650, founded in 1994
Activity	Development and manufacture of car accessories (combined dashboard instruments – engine revolution counters and speedometers)
Status	100% subsidiary of the concern Siemens VDO Automotive AG, Germany
Code	N, E

Name	STROM telecom, s.r.o.
Address	Michelská 60, 140 00 Praha 4
URL	www.strom.cz
Number of workers, Year of founding	750, founded in 1993
Activity	Manufacture of telecommunication equipment, information systems, and technologies for operators
Status	Subsidiary of the opened joint stock company of the KNC, Russia (67%), MATRIX 99, a.s. CZ (33%)
Code	B

Name	Tatung Czech, s.r.o.
Address	U Nové hospody 4, Škvrňany, 301 00 Plzeň
URL	www.tatung.com
Number of workers, Year of founding	About 450, founded in 2004
Activity	Manufacture of television sets with LCD and plasma screens
Status	100% subsidiary of Tatung, Taiwan
Code	N

Name	TCT, a.s., Vidče
Address	756 53 Vidče 96
URL	www.tctas.cz
Number of workers, Year of founding	1300, founded in 1993/1948
Activity	Manufacture of television screens
Status	Member of the ECIMEX Group, Czech Republic
Code	N

Name	TEMOS Tools, a.s.
Address	Modlanská 1, 415 01 Teplice
URL	www.somet.cz
Number of workers, Year of founding	250, founded in 1939/1949/1995
Activity	Development and manufacture of mechanical and electromechanical measuring devices, gauges, and the provision for calibration services
Status	Czech company, the owner of the trade mark SOMET
Code	I

Name	Tesla, a.s.
Address	Poděbradská 56/186, 180 66 Praha 9 – Hloubětín
URL	www.tesla.cz
Number of workers, Year of founding	750, founded in 1921
Activity	Manufacture of radio and television transmitters, electronic measuring equipment, radio-relay equipment, and micromachining
Status	Czech company
Code	N, D

Name	Tesla Blatná, a.s.
Address	Palackého 644, 388 15 Blatná
URL	www.tesla-blatna.cz
Number of workers, Year of founding	360, founded in 1958
Activity	Manufacture of electronic parts and equipment (resistors, choking coils, photoresistors, opto-couplers with photoresistors) and microwave modules Technology: Photolithography, vacuum deposition, vacuum sputtering
Status	Czech company
Code	A, D, M

Name	TSE, spol. s r.o.
Address	Mánesova 74/390, 371 01 České Budějovice
URL	www.tse.cz
Number of workers, Year of founding	314, founded in 1991
Activity	Development, design and manufacture of electronic parts and equipment for telecommunication facilities, instruments for the anaesthesiology
Status	Czech company
Code	B, H, N,

Name	TTC Holding TTC Telekomunikace, s.r.o. TTC Marconi, s.r.o. And also other companies
Address	Třebohostická 5, 100 00 Praha 10
URL	www.ttc.cz
Number of workers, Year of founding	400, founded in 1953/1992
Activity	Manufacture of microelectronic parts for the transmission of telephones, data, and radio signals
Status	Holding TTC Marconi, s.r.o. is a joint-venture by TTC Telekomunikace and Marconi, plc. (UK)
Code	B

Name	Tyco Miniaturisation Czech, s.r.o.
Address	K AMP 1293, 664 34 Kuřim
URL	www.amp.com; www.tyco.com
Number of workers, Year of founding	1500, founded in 1993
Activity	Manufacture of electronic parts (especially of connectors for electronics and optoelectronics)
Status	100% subsidiary of Tyco Group S.a.r.l., Luxembourg
Code	A

Name	Vishay Electronic, spol s r.o.
Address	Mlýnská 1095, 334 01 Přeštice
URL	www.vishay.com
Number of workers, Year of founding	1500 (including operations in Blatná, Prachatice, Volary and Dolní Rychnov near Sokolov), founded in 1991
Activity	Manufacture of parts for electronics (resistors, condensers, etc.)
Status	100% owner – Vishay Europe GmbH., Germany
Code	A

4.2 SMALL AND MEDIUM-SIZE ENTERPRISES

Name	2N telekomunikace, a.s.
Address	Modřanská 621/72, 143 01 Praha 4
URL	www.2n.cz
Number of workers, Year of founding	About 100, founded in 1991
Activity	Manufacture of telecommunication equipment (GSM, PBX, etc.)
Status	Czech company
Code	B,

Name	AEV, spol. s r.o.
Address	Jožky Silného 2783, 767 01 Kroměříž
URL	www.aev.cz
Number of workers, Year of founding	220, founded in 1991
Activity	Development and manufacture of electronic instruments for cars, aircraft, and the light technology
Status	Czech company
Code	N

Name	Aseko, spol. s r.o.
Address	Vídeňská 340, 252 42 Vestec u Prahy
URL	www.aseko.cz
Number of workers, Year of founding	20, founded in 1990
Activity	Development and manufacture of gas sensors (detection systems for CO and other gases)
Status	Czech company
Code	E

Name	AVIKO Praha, s.r.o.
Address	Na Hutmance 2, 158 00 Praha 5
URL	www.volny.cz/vns.aviko
Number of workers, Year of founding	50, founded in 1990
Activity	Design and manufacture of special equipment (metal detectors, optical measuring of part sizes, manipulators, measuring of small differential pressures, etc.)
Status	Czech company, a subsidiary of HVM Plasma, s.r.o., CZ
Code	F, I, M

Name	Awos, s.r.o.
Address	Výzkumná 79, 533 51 Pardubice VII
URL	www.awos.cz
Number of workers, Year of founding	50, founded in 1991
Activity	Development and manufacture of electronic parts and systems and the manufacture of PCBs
Status	Czech company
Code	N

Name	Barco, spol. s r.o.
Address	Okružní 741, 686 05 Uherské Hradiště-Mařatice
URL	www.barco.cz
Number of workers, Year of founding	12, founded in 1993
Activity	Development and manufacture of bar code sensors, terminals, label printers, and wireless networks
Status	Czech company
Code	E, N

Name	Barco Manufacturing, s.r.o.
Address	Billundská 2756, 272 01 Kladno
URL	www.barco.com
Number of workers, Year of founding	100, founded in 2000
Activity	Manufacture of displays
Status	100% subsidiary of Barco NV, Belgium
Code	A

Name	BD Sensors, s.r.o.
Address	Hradišťská 817, 68708 Buchlovice
URL	www.bdsensors.cz
Number of workers, Year of founding	50-99, founded in 1993
Activity	Manufacture and supplies of pressure sensors, level sensors, and of the accessories
Status	Czech company
Code	G, N

Name	Befra-Electronic, s.r.o.
Address	K Prádlu 858, 735 35 Horní Suchá
URL	www.befra.cz
Number of workers, Year of founding	150, founded in 1992
Activity	Manufacture of PCBs
Status	100% subsidiary of Bebro electronics GmbH, Germany
Code	N

Name	BVT Technologies, a.s.
Address	Hudcova 78, 612 00 Brno
URL	www.bvt.cz
Number of workers, Year of founding	5, founded in 1990
Activity	Development and manufacture of substrates for electrochemical sensors

	and bio-sensors, and manufacture of micropumps
Status	Czech company
Code	E, H, J

Name	Carl Zeiss, spol. s r.o.
Address	Radlická 14, 150 00 Praha 5
URL	http://www.zeiss.cz/
Number of workers, Year of founding	47, founded in 1993
Activity	Marketing and services in the area of microscopy, medical technology, optical-electronic systems, semiconductor technology, industrial measuring technology, and optics
Status	100% subsidiary of Carl Zeiss B.V., Germany
Code	G, H, M

Name	C-com, s.r.o.
Address	U Moruší 888, 530 06 Pardubice VI - Svítkov
URL	www.c-com.cz
Number of workers, Year of founding	50-99, founded in 1994
Activity	Manufacture of RF and passive microwave parts and subsystems (duplexers, filters, dividers, pre amplifiers, etc.) and the manufacture of ceramic materials and parts
Status	Member of the Andrew Corp. Group, USA
Code	N, B, L

Name	CRYTUR, s.r.o.
Address	Palackého 175, 541 01 Turnov
URL	www.crytur.cz
Number of workers, Year of founding	25-49, founded in 1943/1998
Activity	Scintillation materials and detectors, laser rods and components (mirrors), precise optics and mechanics, and sapphirine profiles
Status	Czech company
Code	L, M

Name	CUBE CZ, s.r.o.
Address	Ferdinandov 612, 463 62 Hejnice
URL	www.cube.cz
Number of workers, Year of founding	40, founded in 1998
Activity	Manufacture of single and multilayer boards for printed circuits
Status	Czech company
Code	N, A

;Name	CZ-elektronika, s.r.o.
Address	Náchodská ul., 549 01 Nové Město nad Metují
URL	www.cz-elektronika.cz
Number of workers, Year of founding	40, founded in 1996
Activity	Manufacture of PCBs, assembly of electronic products, and photovoltaic applications (since 2002)
Status	Czech company
Code	N

Name	Če Me Bo, s.r.o.
Address	Poříčí 1602/24, 678 01 Blansko
URL	www.cemebo.cz
Number of workers, Year of founding	50, founded in 1994
Activity	Manufacture of PCBs
Status	Czech company
Code	N
Name	Delong Group Delong instruments, a.s. Delong industrial, a.s.
Address	Bulharská 48, 612 00 Brno Purkyňova 99, 612 00 Brno
URL	www.lv-em.com www.dicomps.com ; www.diindustrial.com;
Number of workers, Year of founding	60, founded in 1992 200, founded in 1994
Activity	Research, development, and manufacture of scientific equipment and special electronics (electron microscopes, roentgen analysers, neutron radiation systems, surgical gamma-probes)
Status	Czech company
Code	G, H, N

Name	ELCERAM, s.r.o.
Address	Okružní 1144, 500 03 Hradec Králové
URL	www.elceram.cz
Number of workers, Year of founding	150, founded in 1994
Activity	Manufacture of white and printed ceramic substrates (corundum ceramics)
Status	The owner is the Czech company ESGK, s.r.o.
Code	L

Name	ELIS Plzeň, a.s.
Address	Luční 15, 304 26 Plzeň
URL	www.elis.cz
Number of workers, Year of founding	45, founded in 1990/1997
Activity	Development and manufacture of ultrasound water meters, ultrasound and inductive flow-meters and heat meters in water and steam
Status	Czech company
Code	N

Name	Elmarco, s.r.o.
Address	V Horkách 76, Liberec 9, 460 07
URL	www.elmarco.cz
Number of workers, Year of founding	80, founded in 2000
Activity	Manufacture of systems for the dosing of chemicals in the process of surface treatments of silicon wafers and the development and manufacture of equipment for the manufacturing of polymer nanofibre non woven textiles
Status	Czech company
Code	F

Name	ELMET, spol. s r.o.
Address	Nádražní 889, 535 01 Přelouč
URL	www.elmet.cz
Number of workers, Year of founding	55, founded in 1991
Activity	Manufacture of PCBs and the manufacture of electronic equipment
Status	Czech company
Code	N

Name	ELTON hodinářská, a.s.
Address	Náchodská 2105, 549 01 Nové Město nad Metují
URL	www.elton.cz
Number of workers, Year of founding	30, 1998/1949
Activity	Manufacture of watches of the brand PRIM, the fine engineering
Status	Czech company
Code	N

Name	ESY, s.r.o.
Address	Americká 856/78, 460 10 Liberec 3
URL	www.esy.cz
Number of workers, Year of	30, founded in 1995

founding	
Activity	Development and manufacture of custom-made electrotechnology (control technology for thermal processes, measuring technology, and information displays), and the manufacture of custom-made software
Status	Czech company
Code	N

Name	FEI Czech Republic, s.r.o.
Address	Podnikatelská 2956/6, 612 00 Brno
URL	www.feicompany.com
Number of workers, Year of founding	166, founded in 1992
Activity	Development and manufacture of electron microscopes
Status	Subsidiary of FEI Electron Optics International B.V.
Code	G, H

Name	GeneAge Technologies, a.s.
Address	Pod kaštany 3/5, 160 00 Praha 6
URL	www.geneagetech.com
Number of workers, Year of founding	<10, founded in 1999
Activity	Development of the DNA chip technology, the custom-made manufacture of recombinant proteins, and products for the molecular genetics
Status	Czech company
Code	H

Name	GEN-TREND, s.r.o.
Address	Dolní 2, 370 04 České Budějovice
URL	www.gentrend.cz
Number of workers, Year of founding	< 5, founded in 1996
Activity	Development and manufacture of diagnostic sets used for the detection and quantification of pathogenic micro organisms by the reverse hybridisation on the micro-array chips
Status	Czech company
Code	H

Name	Goldcard, s.r.o.
Address	Větrná 401, 686 05 Uherské Hradiště
URL	www.goldcard.cz
Number of workers, Year of founding	20-24, founded in 1991
Activity	Development and manufacture of identification systems and components (terminals, readers, etc.)

Status	Czech company
Code	N

Name	Harlingen, s.r.o.
Address	Dvořákova 328, 563 01 Lanškroun
URL	www.harlingen,cz
Number of workers, Year of founding	20-24, founded in 2004
Activity	Manufacture of parts for microelectronics: Precise thin layer resistors Thermal nickel sensors Linear converters Cermet resistance three-grid valves and others
Status	Czech company (which has taken over a part of the former production facilities of Tesla Lanškroun)
Code	A

Name	HC miniaturisation, s.r.o.
Address	Kalendova 688, 500 04 Hradec Králové
URL	www.hcminiaturisation.cz
Number of workers, Year of founding	65, founded in 1993
Activity	Fitting of printed circuits with a mixed and surface assemblies, development and manufacture of crystalline oscillation generators, development and manufacture of hybrid integrated circuits, and sales of SMD parts in sets, or individually
Status	Czech company
Code	A

Name	Hokami CZ, s.r.o.
Address	Ampérova 464, 460 08 Liberec 8
URL	www.hokami.cz
Number of workers, Year of founding	60, founded in 1997
Activity	Manufacture of PCBs
Status	Czech company
Code	N

Name	HVM Plasma, s.r.o.
Address	Na Hutmance 347/2, 158 00 Praha 5-Jinonice
URL	www.hvm.cz
Number of workers, Year of founding	60, founded in 1992
Activity	Manufacture and services: Technology for the coating by the PVD and

	PACVD methods made on order (hard layers, tribological coatings – DLC, and decorative coatings). Research and development: Development of coating technologies, development of particle sources (magnetrons, arched and ion sources), modelling, analyses of thin layers, and plasma diagnostics
Status	Czech company
Code	L, F

Name	IMA, s.r.o.
Address	Pod Vodovodem 2, 158 01 Praha 5
URL	www.ima.cz
Number of workers, Year of founding	45, founded in 1992
Activity	Development and application of integrated identification systems, GSM technology, and car electronics
Status	Czech company
Code	N, B

Name	Incline Global Technology Services (Czech), s.r.o.
Address	Jakubská 647/2, Praha 1, 11000
URL	www.incline-qts.com
Number of workers, Year of founding	10-19, founded in 2005
Activity	Repairs of LCD panels in notebooks, LCD television sets, and plasma screens
Status	100% subsidiary of Incline Global Technology Service, Inc., United Kingdom
Code	N

Name	Krystaly Hradec Králové, a.s.
Address	Okružní 1144, 500 03 Hradec Králové
URL	www.krystaly.cz.
Number of workers, Year of founding	130, founded in 1996
Activity	Manufacture of piezoelectric crystalline units, crystalline filters, and crystalline oscillation generators
Status	Czech company
Code	L

Name	Laird technologies
Address	Průmyslová 497, Liberec, 46211
URL	www.edb.cz
Number of workers, Year of founding	200, founded in 2003
Activity	Manufacture of shield materials, conductors of Be copper, power

	conducting textiles and elastomers, microwave absorbers, etc.
Status	99% subsidiary of Laird C.I. Holdings Limited, Caiman Islands
Code	L, A, 3

Name	LAMBDA Praha, s.r.o.
Address	Musílkova 12/488, 150 00 Praha 5
URL	www.lambda.cz
Number of workers, Year of founding	15, founded in 1919/1993
Activity	Manufacture of biological microscopes and optical components (micro lenses, etc.)
Status	Czech company
Code	H

Name	Letecké přístroje, s.r.o.
Address	Pod Hájkem 406/1, 180 00 Praha 8
URL	www.lp-praha.cz
Number of workers, Year of founding	40, founded in 1993
Activity	Development and manufacture of sensors and indicators (revolution counters), magnetic compasses, electromagnetic valves, actuators, electromechanical and electronic aircraft equipment
Status	Czech company
Code	E, N

Name	LISS, a.s.
Address	Zuberská 2603, 256 61 Rožnov pod Radhoštěm
URL	www.liss.cz
Number of workers, Year of founding	50, founded in 1991
Activity	Coating centre equipped with the equipment by Platit Co., Switzerland, galvanic plating (vibroplating), metallisation of non-conducting materials
Status	Czech company
Code	D

Name	M.A.G. Galvanochemie, a.s.
Address	Dvorská 9, 466 01 Jablonec nad Nisou
URL	www.magchem.cz
Number of workers, Year of founding	53, founded in 1999/1993
Activity	Manufacture of chemical compounds for the surface treatment and preparations for the manufacture of printed circuits
Status	Czech company
Code	L

Name	MEGA, a.s.
Address	Drahobejlova 1452/54, 190 00 Praha 9 Pod Vinicí 83, 471 27 Stráž pod Ralskem
URL	www.mega.cz
Number of workers, Year of founding	50-99, founded in 1992
Activity	Development and manufacture of heterogeneous ion-exchanging membranes RALEX for the electrolysis, electrophoresis, electro-deionization, etc., products for biotechnologies (bio-catalysers, e.g. immobilised enzymes and cells in polyvinyl-alcoholic carriers), and the development of membranes for fuel cells
Status	Czech company
Code	J, H

Name	Mesing, spol. s r.o.
Address	Mariánské nám. 1, 617 00 Brno
URL	www.mesing.cz
Number of workers, Year of founding	21, founded in 1990
Activity	Products in the area of the precise mechanics – length measuring devices, indication length sensors, and automatic measuring devices and systems
Status	Czech company
Code	I

Name	MESIT PCB, spol. s r.o.
Address	Sokolovská 573, 686 01 Uherské Hradiště
URL	www.pcb.mesit.cz
Number of workers, Year of founding	55, founded in 1998
Activity	Manufacture of multilayer metallised boards for printed circuits
Status	Czech company, a part of the MESIT Holding, a.s. Group (12 companies)
Code	N

Name	MEV, s.r.o.
Address	Poděbradská 51, 198 00 Praha 9
URL	www.mev.cz
Number of workers, Year of founding	55, founded in 1993
Activity	Manufacture of PCBs
Status	Czech company
Code	N

Name	Microelektronika, spol. s r.o.
Address	Kpt. Poplera 55/III., 566 01 Vysoké Mýto
URL	www.microelektronika.cz
Number of workers, Year of founding	93, founded in 1991
Activity	Automated systems for the checking-in of passengers in the public transport systems, including automats for the sale of tickets (stationary and mobile), electronic markers, chip card readers, time and zone indicators, equipment for the sale of tickets and the supporting control and evaluation equipment for the data processing in PCs. Special control electronics for buses and trucks and the manufacture for spare consumption, e.g. regulators, control equipment, timers, and special automated electronics
Status	Czech company
Code	N

Name	Micro – sensor, spol. s r.o.
Address	Na Libuši 891, 391 65 Bechyně
URL	www.micro-sensor.cz
Number of workers, Year of founding	55, founded in 1991
Activity	Development and manufacture of sensors for the measuring of distance and strength, the development in the field of precise mechanics and electronics
Status	A member of the Micro-Epsilon Messtechnik Group, Ortenburg/Passau since 1992, Germany
Code	E, I

Name	Micro Tek, s.r.o.
Address	Pod Vodovodem 2, Praha 5, 158 00
URL	www.microtek.cz
Number of workers, Year of founding	6-9, founded in 1992
Activity	Design, development and consequent manufacture of custom-made hybrid integrated circuits for the general use and microwave parts and sub systems created by thick layer and thin layer technologies on ceramic and plastic bases
Status	Czech company
Code	A, N

Name	MICROTEL, s.r.o.
Address	Jana Palacha 1573, Roztoky 252 63
URL	www.microtel.cz
Number of workers, Year of founding	1-5, founded in 1993

Activity	Development and manufacture of electronic equipment, especially in the area of telecommunications
Status	Czech company
Code	B, N

Name	MITE Hradec Králové, s.r.o.
Address	Veverkova 1343, 500 02 Hradec Králové
URL	www.mite.cz
Number of workers, Year of founding	20, founded in 1993/1988
Activity	Development and manufacture of microcomputer systems for the industrial applications made on order, equipment for the measuring of micro-gravitation (utilised in 1996 on the space ship Atlantis)
Status	Czech company
Code	N

Name	Mitsubishi Electric Automotive Czech, s.r.o.
Address	Politických vězňů 1564, 274 01 Slaný
URL	www.mitsubishielectric.cz , www.meac.cz/
Number of workers, Year of founding	108, founded in 2000
Activity	Manufacture of electronic units controlling the running of engines, alternators, and starters
Status	Subsidiary of Mitsubishi Electric Corporation, Japan
Code	N

Name	Monokrystaly, s.r.o.
Address	Turnov – Vesecko 487, 511 01 Turnov
URL	www.monokrystaly.cz
Number of workers, Year of founding	1-5, founded in 1968
Activity	Manufacture of ion selective electrodes for the analyses in different fields (medicine, agriculture, food industry, etc.) and pH microelectrodes
Status	Czech company
Code	G, H

Name	MTEL Communications s.r.o.
Address	Krapkova 4, Olomouc, 77200
URL	www.mtelcomms.cz
Number of workers, Year of founding	10-19, founded in 1995
Activity	Design of optical telecommunication and data networks, the complex organisation of all activities related not only to the design of optical routes, but also to the entire assortment of the weak current distribution
Status	Czech company

Code	M, N

Name	OPTAGLIO, s.r.o.
Address	Husinec-Řež 199, 25068 Řež
URL	www.optaglio.cz
Number of workers, Year of founding	45, originally founded in 1994
Activity	Research and development of applications of the electron lithography and the utilisation of lasers, the manufacture of holographic labels, foils, etc.
Status	Optaglio Limited (75%), United Kingdom, Optaglio Holdings Limited (25%)
Code	D, N

Name	OPTOKON Co. Ltd.
Address	Červený Kříž 250, 586 02 Jihlava
URL	www.optokon.cz; www.optokon.com
Number of workers, Year of founding	100, founded in 1991
Activity	Research, development, and manufacture of optoelectronic parts and equipment, especially for fibre optics and electronics. Activities of the accredited calibration laboratory related to the optical measuring equipment
Status	The company is a primary optical division of Methode Miniaturisation, Inc., USA, which owns 75% shares
Code	M

Name	PCB Benešov, a.s.
Address	Jana Nohy 1352, 256 01 Benešov
URL	www.pcb-benesov.cz
Number of workers, Year of founding	77, founded in 1992
Activity	Manufacture of boards with multiple printed circuits
Status	Czech company
Code	N

Name	PIVOT, a.s.
Address	Průmyslová 3020/3, 787 01 Šumperk
URL	www.pivot.cz
Number of workers, Year of founding	25-49, founded in 2002
Activity	Development of new coating technologies and manufacture of coating equipment
Status	Joint enterprise of PLATIT AG, Switzerland, and SHM, s.r.o. from Nový Malín

Code	F

Name	Pragoboard, s.r.o.
Address	Technologický park Běchovice, 190 11 Praha 9
URL	www.pragoboard.cz
Number of workers, Year of founding	founded in 1997
Activity	Manufacture of PCBs and micromachining
Status	Czech company
Code	N, D

Name	RealTime Technologies, s.r.o.
Address	Veská 35, 533 04 Sezemice (Pardubice)
URL	www.realtimetec.cz
Number of workers, Year of founding	9, founded in 2003
Activity	Repairs of PCBs, construction of PCB prototypes
Status	100% subsidiary of Realtime Technologies, Dublin, Ireland
Code	N

Name	Reflex, s.r.o.
Address	Novodvorská 994, 142 00 Praha 4
URL	www.reflex-co.cz
Number of workers, Year of founding	14, founded in 1996
Activity	Research and development of precise roentgen optics and scientific video cameras, the manufacture of micro mirrors, roentgen video cameras for the roentgen diffractometry and fluorescent roentgen analyses
Status	100% subsidiary of Bede, plc., United Kingdom
Code	G, M, N

Name	SHM, s.r.o.
Address	Průmyslová 3020/3, Šumperk, 78701
URL	www.shm-cz.cz
Number of workers, Year of founding	25-49, founded in 1993
Activity	Research, development and design of wear-resistant layers by the PVD technology, nanolayers MARWIN
Status	Czech company
Code	L

Name	SPEEL Praha, s.r.o.
Address	Beranových 130, 199 05 Praha 9
URL	www.speel.cz

Number of workers, Year of founding	44, founded in 1998
Activity	Development and manufacture of fixed memory banks for aircraft recorders and monitoring systems, and electronic speedometers
Status	Czech company
Code	N

Name	STARMANS Miniaturisation, s.r.o.
Address	V zahradách 24/836, 180 00 Praha 8 – Libeň
URL	www.starmans.cz
Number of workers, Year of founding	35, founded in 1993
Activity	Research, development and manufacture of industrial ultrasound systems (probes, thickness meters, defectoscopes) and roentgen scanning systems
Status	Czech company
Code	G, I, N

Name	STROBOS, s.r.o.
Address	Křižíkova 68, 61200 Brno-Královo Pole
URL	
Number of workers, Year of founding	<10, founded in 1999
Activity	Manufacture of instruments, equipment and special machines for different industries
Status	Czech company
Code	N

Name	SVM Microwaves, s.r.o.
Address	U Mrázovky 5, 150 00 Praha 5
URL	www.svm.cz
Number of workers, Year of founding	6-9, founded in 1994
Activity	Development and manufacture of highly advanced and unique electronic equipment like, for example, microwave radio-relay connections, microwave television distribution systems, multi-point systems for the distribution of the Internet, etc.
Status	Czech company
Code	B, G, N

Name	TECO, a.s..
Address	Havlíčkova 260, 280 02 Kolín
URL	www.tecomat.cz
Number of workers, Year of	85, founded in 1919/1994

founding	
Activity	Development and manufacture of programmed control automats and programmed management systems
Status	Czech company
Code	N

Name	TESCAN, s.r.o.
Address	Libušina třída 21, 623 00 Brno
URL	www.tescan.cz
Number of workers, Year of founding	30, founded in 1991
Activity	Development and manufacture of scanning electron microscopes and equipment for the image processing
Status	Czech company
Code	G, H

Name	Tesla Tech, s.r.o.
Address	Klášterní 1, 259 01 Votice
URL	www.teslatech.cz
Number of workers, Year of founding	200, founded in 1998
Activity	Manufacture of PCBs
Status	Czech company, subsidiary of Strom telecom, s.r.o.
Code	N

Name	TESLA V.T. MICROEL, s.r.o.
Address	Nademlejnská 600, 198 00 Praha 9
URL	www.tesla-microel.cz
Number of workers, Year of founding	25, founded in 1993
Activity	Development and manufacture of magnetrons for the radiolocation technology, transit-time tubes for television transmitters, and the linear accelerator 4 MEV
Status	Czech company
Code	N, 0

Name	Unicontrols, a.s..
Address	Křenická 2257, 10000 Praha 10-Strašnice (část)
URL	www.unicontrols.cz
Number of workers, Year of founding	136, founded in 1991
Activity	Manufacture of electric engines, generators and transformers, telephone and telex equipment and exchanges, radio and television receivers, including the equipment for the recording and image and sound playback, and other similar equipment

Status	Czech company
Code	B, G

Name	UNIS Brno, s.r.o.
Address	Jundrovská 33, 624 00 Brno
URL	www.unis.cz
Number of workers, Year of founding	190, founded in 1990
Activity	Complex solutions of industrial automation, integrated systems, robotics, and car electronics
Status	Czech company
Code	N

Name	UVB Technik, s.r.o.
Address	Ostravská 79A, 748 01 Hlučín
URL	www.uvbtechnik.cz
Number of workers, Year of founding	14, founded in 1991/1993
Activity	Development and manufacture of the equipment for precise measuring of metal strip thickness (±1μm)
Status	Czech company
Code	I

Name	VAKUUM Praha, spol. s r.o.
Address	V Holešovičkách 747/2, 180 00 Praha 8-Libeň
URL	www.vakuum.cz
Number of workers, Year of founding	35, founded in 1993
Activity	Development and manufacture of vacuum and ultra vacuum components, ultra vacuum systems for research and development, vacuum systems for particle accelerators, machine parts, and precise mechanical parts
Status	Czech company
Code	G

Name	Wendell Miniaturisation, a.s
Address	Tovární 368, 563 01 Lanškroun
URL	www.wendell.cz
Number of workers, Year of founding	60, founded in 2002
Activity	Mass manufacture of PCBs
Status	Czech company
Code	N

4.3 REVIEW OF ACTIVITY OF LARGE COMPANIES, ACCORDING TO THE CODES

Large companies have been classified, within differing scopes, in the code groups A, B, D, E, I, L, M, and N. Seventeen large companies were classified in the group N – Other products belonging among the microtechnological equipment and the manufacture of equipment (instruments and systems) containing microtechnological parts or systems (e.g. computers, different instruments and equipment, consumer electronics, etc.). Ten companies were classified within the group A – Semiconductors and parts for microelectronics, 6 companies were classified within the group E – Micro sensors, 5 companies within the group L – Materials for microtechnologies, and two companies were classified within the groups D – Microtechnology, I – Metrology, and M – Optics and optoelectronics. One company was classified within the group B – Communication microsystems.

Group A comprises: **AEG Components** (condensers), **AVX** (condensers), **ELTES** (resistors and potentiometers), **EPCOS** (manufacture of passive electronic parts made of ferrits), **ON Semiconductor** (Si wafers, semiconductor parts), **Oprex** (LCD displays), **Polovodiče** (semiconductor parts), **Tesla Blatná** (resistors, photoresistors, opto-couplers, and other electronic parts), **Tesla Jihlava** (custom-made connectors), **TYCO** (connectors for electronics and optoelectronics), and **Vishay** (resistors and condensers).

Group B comprises: **TTC Holding** (microelectronic parts for telecommunications).

Group D comprises: **Tesla, a.s**. (micromachining) and **Tesla Blatná** (photolithography, vacuum depositing).

Group E comprises: **BRISK Tábor** (revolution counters, level gauges), **Connaught** (acceleration sensors, etc.), **CHERRY** (acceleration sensors, etc.), **ON Semiconductor** (semiconductor detectors of radiation), **Tesla Jihlava** (NO_x sensors, accelerators), and **Siemens VDO** (revolution counters).

Group I comprises: **Metra Blansko** (metrology) and **TEMOS Tools** (the manufacture of measuring equipment and calibration services).

Group L comprises: **BRISK Tábor** (technical ceramics), **EPCOS** (manufacture of passive electronic parts made of ferrits), **ON Semiconductor** (monocrystalline Si), **Polovodiče** (Si monocrystals and boards), **Safina** (prefabricates and chemicals containing precious metals), and **Saint Gobain** (special ceramics).

Group M comprises: **Infineon** (optoelectronic converters, light conducting cables, laser and receiving diodes, etc.) and **Tesla Blatná** (photodetectors).

Group N comprises: **ALPS** (manufacture of keyboards, RF modulators, TV tuners, and satellite converters), **ASU** (manufacture and repairs of computers), **Celestica Kladno** (assembly of mobile telephones, assembly and manufacture of PCBs), **Celestica Ráječko** (assembly and manufacture of PCBs, manufacture of memories), **EPIQ** (manufacture of PCBs), **FIC** (manufacture of PCBs, graphic cards, and computers), **FOXCONN** (manufacture of computers and PCBs), **LG Philips** (manufacture of TV screens and parts), **Matsushita Com**. (assembly of mobile telephones and manufacture of car radio sets), **METRA Blansko** (manufacture of electric measuring instruments and equipment), **Panasonic AVC**

(manufacture of television sets), **Tatung** (manufacture of television sets), **TCT** (manufacture of TV screens), **Tesla, a.s.** (RF and TV transmitters, electronic measuring equipment), **Tesla Jihlava** (electromechanical parts for the automotive industry, keyboards, etc.), and **Siemens VDO** (manufacture of car accessories).

4.4 REVIEW OF ACTIVITIES OF SMALL AND MEDIUM-SIZE ENTERPRISES, ACCORDING TO THE CODES

Small and medium-size enterprises have been classified in all code groups, with the exception of the codes C – MEMS, MOEMS, and K – Microthermal systems. The largest number of small and medium-size enterprises has been classified, similarly like in the case of large enterprises, in the group N – Other products of the microtechnological equipment, or the manufacture of equipment containing microtechnological parts or systems (38 companies). Ten companies were classified within the groups H – Microsystems for the utilisation in biotechnology and medicine, and L – Materials. Seven companies were classified within the groups A – Semiconductors and parts for microelectronics, and G – Microanalytical equipment etc.

Group A comprises: **Barco Man**. (manufacture of displays), **CUBE** (manufacture of single layer and multilayer boards with printed circuits), **Harlingen** (resistors, thermal sensors, converters, trimers, etc.), **HC Electronic** (development and manufacture of crystalline oscillation generators, development and manufacture of hybrid integrated circuits), **Laird** (manufacture of microwave absorbers and shield materials), and **Micro Tek,** s.r.o. (manufacture of custom-made hybrid integrated circuits).

Group B comprises: **2N** (manufacture of telecommunication equipment), **C-com** (manufacture of RF and passive microwave parts and sub systems (duplexers, filters, dividers, pre amplifiers, etc.), **IMA** (GSM technology), **Microtel** (manufacture of the equipment for the control of telecommunication traffic and for the measuring of the traffic load), **SVM Microwaves** (development and manufacture of microwave radio-relay connections), and **Unicontrols** (systems for the dispatching controls and management systems for railway vehicles).

Group D comprises: **LISS** (the coating centre equipped with the equipment by Platit, galvanic-plating (Vibroplating), metallisation of non conducting materials), **Optaglio** (research and development of applications of the electron lithography and the utilisation of lasers), and **Pragoboard** (micromachining).

Group E comprises: **ASEKO** (development and manufacture of gas (CO) sensors - detection systems, etc), **Barco** (bar code sensors), **BVT Technologies** (electrochemical sensors and biosensors), **Letecké přístroje** (manufacture of sensors and indicators – revolution counters, etc.), and **Micro-sensor** (development and manufacture of sensors for the measuring of distances and strength).

Group F comprises: **AVIKO** (manufacture of manipulators), **ELMARCO** (manufacture of systems for the dosing of chemicals in the process of surface treatment of silicon boards, development and manufacture of the equipment for the manufacture of polymer nanofibre not woven textiles), **HVM Plasma** (the technology of coating by the PVD and PACVD methods made on order), and **PIVOT** (development of new coating technologies and the manufacture of coating equipment).

Group G comprises: **BD Sensors** (manufacture of pressure sensors), **Delong** (development and manufacture of electron microscopes and roentgen analysers), **Carl Zeiss** (marketing and service of the brand optics, microscopy, medical technology, etc.), **FEI** (manufacture of electron microscopes), **Monokrystaly** (manufacture of ion selective electrodes for the analyses in different fields (medicine, agriculture, food industry, pH microelectrodes), **Reflex** (development and manufacture of roentgen video cameras for the roentgen diffractometry and fluorescent roentgen analyses), **SVM Microwaves** (development and manufacture of microwave radio-relay connections), **STARMANS** (development and manufacture of roentgen scanning systems), **TESCAN** (development and manufacture of scanning electron microscopes and the equipment for the image processing), **VAKUUM** (development and manufacture of vacuum and ultra vacuum components, the ultra vacuum systems for research and development, vacuum systems for the particle accelerators), and **Unicontrols** (systems for telemetering and data transfers).

Group H comprises: **BVT** (development and manufacture of biosensors), **Carl Zeiss** (surgical microscopes, optical biometry, optical tomography, etc.), **Delong** (development and manufacture of surgical gamma probes), **FEI** (manufacture of electron microscopes), **GeneAge** (DNA chip development technology, custom-made manufacture of recombined proteins, products for the molecular genetics), **GEN-TREND** (development and manufacture of diagnostic sets for the detection and quantification of pathogenic micro organisms by the reverse hybridization on the micro-array chips), **LAMBDA** (manufacture of biological microscopes), **MEGA** (development and manufacture of heterogeneous ion-exchanging membranes RALEX for the electrolysis, electrophoresis, electro-deionization, etc., products for biotechnologies (bio-catalysers, e.g. immobilised enzymes and cells in polyvinyl-alcoholic carriers)), **Monokrystaly** (manufacture of ion selective electrodes for the analyses in different fields (medicine, agriculture, food industry), pH microelectrodes), **TESCAN** (development and manufacture of raster electron microscopes and the equipment for the image processing), and **TSE** (manufacture of instruments for anaesthesiology).

Group I comprises: **AVIKO** (measuring of small differential pressures), **Mesing** (products in the area of precise mechanics – length meters, indication length sensors, automated measuring devices and systems), **Micro-sensor** (sensors for the measuring of length and strength), **STARMANS** (development and manufacture of roentgen scanning systems), and **UVB Technik** (development and manufacture of the equipment for the precise measuring of metal strip thickness (±1μm)).

Group J comprises: **BVT Technologies** (manufacture of electrochemical sensors) and **MEGA** (development and manufacture of membranes for fuel cells).

Group L comprises: **C-com** (ceramic materials and parts), **Crytur** (scintillation materials and detectors, sapphirine profiles), **ELCERAM** (manufacture of the corundum ceramics), **HVM Plasma** (hard layers – LCD), **Krystaly** (manufacture of piezoelectric crystalline units, crystalline filters and crystalline oscillation generators), **Laird** (manufacture of conductors of Be copper, power conducting textiles and elastomers), **MAG** (manufacture of chemical compounds for the surface treatment), and **SHM** (hard nanolayers).

Group M comprises: **AVIKO** (equipment for the optical measuring), **Carl Zeiss** (eye optics, binoculars, the equipment for night vision), **Crytur** (laser rods and components - mirrors, precise optics and mechanics), **MTEL Communications** (PMD measuring, chromatic CD, polarisation mode dispersion of a single mode optical routes), **Optokon**

(research, development and manufacture of optoelectronic parts and equipment, especially for the fibre optics and electronics), and **Reflex** (manufacture of the precise roentgen optics and micro mirrors).

Group N comprises: **AEV** (development and manufacture of electronic equipment for cars, aeroplanes, and light technology), **Awos** (development and manufacture of electronic parts and systems, manufacture of PCBs), **Barco** (manufacture of terminals and label printers), **BD Sensors** (manometers, level gauges, etc.), **C-com** (manufacture of RF and passive microwave parts and sub systems (duplexers, filters, dividers, pre amplifiers, etc.)), **Befra** (manufacture of PCBs), **CUBE** (manufacture of PCBs), **CZ-elektronika** (manufacture of PCBs, assembly of electronic products), **ČEMEBO** (manufacture of PCBs), **Delong** (research, development and manufacture of scientific equipment and special electronics), **ELIS** (development and manufacture of ultrasound water meters, ultrasound and induction flow meters, and the heat measuring devices in water and steam), **ELMET** (manufacture of PCBs and electronic equipment), **ELTON** (manufacture of watches of the brand PRIM, precise engineering), **ESY** (development and manufacture of custom-made electrotechnology – control technology for thermal processes, measuring technology, and information displays), **Goldcard** (development and manufacture of identification systems and components - terminals, readers, etc.), **Hokami** (manufacture of PCBs), **IMA** (development and applications of integrated identification systems, GSM technology, car electronics), **Incline** (repairs of LCD panels in notebooks, LCD television sets and plasma screens), **Letecké přístroje** (manufacture of magnetic compasses, electromagnetic valves, actuators, and electromechanical and electronic aircraft equipment), **PCB Benešov** (manufacture of PCBs), **MESIT** (manufacture of PCBs), **MEV** (manufacture of PCBs), **Microelektronika** (automated systems for the check-ins of passengers in the public transport, including automats issuing tickets (stationary and mobile ones), electronic markers, readers of chip cards, time and zone displays, equipment for the issuance of tickets and the support control and assessment equipment for the data processing with PCs), **Micro Tek** (microwave parts and sub systems for the utilisation, inter alia, in telecommunications), **MICROTEL** (development of telephone PK and MK exchanges), **MTEL Communications** (microtubes and microcables), **MITE** (development and manufacture of microcomputing systems for the custom-made industrial applications), **Mitsubishi El.** (manufacture of electronic units controlling the engine runs, alternators, and starters), **Optaglio** (manufacture of holographic labels and films), **Pragoboard** (manufacture of PCBs), **RealTime** (repairs and design of PCB prototypes), **Reflex** (manufacture of scientific video cameras), **SPEEL** (development and manufacture of fixed memories for aircraft recorders and aircraft monitoring systems, and electronic speedometers), **STARMANS** (research, development and manufacture of industrial ultrasound systems (probes, thickness meters, defectoscopes)), **STROBOS** (manufacture of mechanical parts for machines), **SVM Microwaves** (converters), **TECO** (development and manufacture of programmed control automats and programmed control systems), **TESLA Tech** (manufacture of PCBs), **TESLA VT** (development and manufacture of magnetrons for the radiolocation technology, transit-time tubes for television transmitters, linear accelerators 4 MEV), **UNIS** (complex solutions of the industrial automation, integrated systems, robotics, and car electronics), and **Wendell** (mass manufacture of PCBs).

5. SUMMARY EVALUATION OF RESEARCH AND MANUFACTURING ACTIVITIES IN THE AREA OF MICROTECHNOLOGIES

5.1 RESEARCH AND DEVELOPMENT

The review of activities by research workplaces, in the Sub Chapter 3.2., clearly shows that there are a number of research projects running, the results of which could be utilised in practice, if they were application-oriented. However, we must stress that a large majority of these research works can be utilised in microtechnologies only potentially and they are not conducted for this purpose. The exceptions are the workplaces at the Faculty of mechatronics TUL and the workplaces of the Department of precise mechanics and optics in the Institute of instrument and control technology in the Faculty of engineering at ČVUT, which resolves also practice-oriented projects.
The running basic and target-oriented basic research, which could be applied in microtechnologies, could be divided into the following areas:

- Microelectronics - Research of semiconductors (the production technologies and the semiconductor properties), the development in the design of integrated circuits, and the research of different materials,
- Optics and optoelectronics – Research of optical materials, lasers, optical instruments, and the preparation and properties of optical waveguides, optical sensors, etc.,
- Microsystems usable in biotechnology and medicine – Research of bio-compatible materials, bio-sensors, microanalytical methods, microchips, different instruments, etc.,
- Micro sensors – utilised in different fields (from the automotive industry and the environment to medicine).

However, in the majority of cases, there are no offers by research workplaces. Even demands related to research work results are still missing because most Czech companies, which utilise microtechnologies, are owned by foreign owners, who have brought modern technologies from abroad and their understanding and knowledge of high qualities and capacities of Czech research workplaces are still unsatisfactory.
The number of projects implemented in research areas in the period 2002-2005, according to the classification described in the Sub Chapter 2.2. is presented in Fig. 1. The level of public funds assigned to individual research areas is clearly shown in Fig. 2. The projects were looked for in the CEP database[7], according to science fields – "Sensors, measuring, and regulation", "Utilisation of computers, robotics, and their applications", "Electronics and optoelectronics, and electrotechnology", by insertion of the key word "micro", and also the key word "fine/precise mechanics".
The Czech state has provided 67% of the funding - CZK 447.2 million – for 116 projects, the total budget of which reached CZK 669.4 million. Most research projects have been focussed on the area L – Materials for microtechnologies (particles, layers, composites, etc.) and most funds from the state budget (provided for by the Grant Agency of the Czech Republic, the Grant Agency of the Academy of Sciences of the Czech Republic, the Ministry of Industry and Trade of the Czech Republic, and the Ministry of Education, Youth and Sports of the Czech Republic) went to the area F – Manufacturing equipment for microtechnologies and their parts.

[7] Central registry of research and development projects - CEP, prepared by Inova Pro, s.r.o. in July 2005

The focuses of individual research and development workplaces are presented, well arranged, in the **Annex No. 1**.

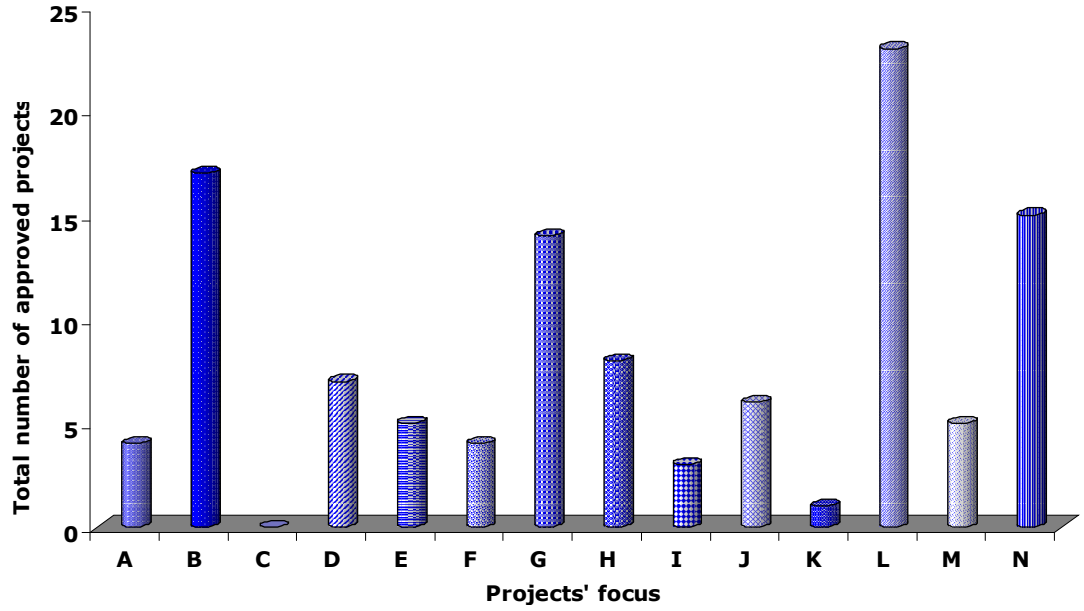

Fig. 1: Division of the national projects, according to the classification described in 2.2.

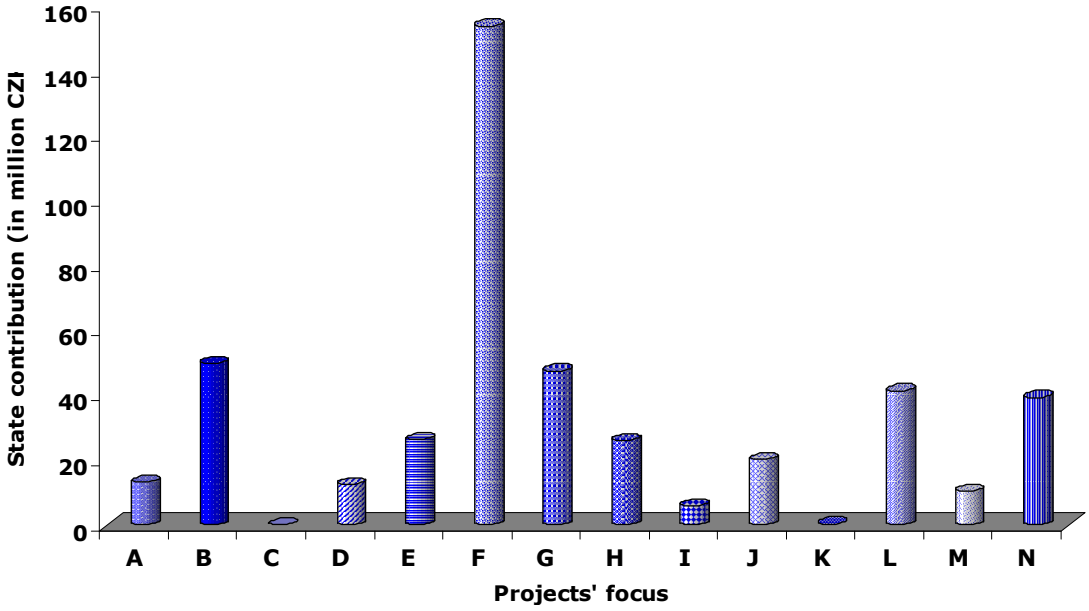

Fig. 2: Division of the financial contributions, according to the projects' focus (see the classification in 2.2.)

5.2 MANUFACTURING COMPANIES

There are companies characterised in the report, which are involved mostly in the manufacture of materials and components for microtechnologies, the manufacture of microtechnological equipment, or the equipment, which contains microtechnological parts or microsystems. In some cases, these companies organise also their own research and development. The end users of products of the mentioned companies are mostly domestic and foreign car and aircraft makers, manufacturers of consumer electronics, computers, and communication technology. There were also companies evaluated (especially large companies with foreign participation), which utilise microtechnologies and microtechnological products, when completing their own products like, for example, computers, mobile telephones, television sets, etc. We have evaluated also companies focusing on the manufacture and assembly of printed circuit boards (PCBs).
The review of company focuses (especially of large companies and SMEs) is presented in **Annexes No. 2 and No. 3.**

6. CONCLUSIONS

The completed analysis and evaluation present the following conclusions:

- Research activities in the area of microtechnologies have been extensive and include a relatively high number of workplaces, which could be characterised by different work quality and capacity,
- Mostly target-oriented basic research prevails, which, with some exceptions, focuses on the utilisation of results in practice,
- There are offers by research workplaces missing and there is only limited demand by manufacturing companies,
- Research teams in institutes of the Academy of Sciences of the Czech Republic, which are involved in individual research projects, are larger than those at universities,
- The private sector has got only smaller development workplaces, which are involved in research and development in the area of microtechnologies, and they focus mostly on microelectronics. They are also mostly owned by foreign subjects,
- Electronic industry and the manufacture of cars make the main driving force in the development of microtechnologies in the Czech Republic,
- Both large companies and SME play important roles in the development of microtechnologies in the Czech Republic.

Annex No. 1

Index of R&D workplaces and the field of applications		A - Semiconductor and parts for microelectronics	B - Communications microsystems	C - MEMS, MOEMS	D - Micro-scale technologies (mechanical micromachining, lithography, and chemical and other technologies)	E - Micro sensors	F - Manufacturing equipment for microtechnologies and their parts	G - Microanalytical equipment, its parts, and analytical methods	H - Microsystems for the use in biotechnology and medicine	I - Metrology	J - Microchemical systems	K - Microthermal systems	L - Materials for microtechnologies (particles, layers, composites, etc.)	M - Optics and optoelectronics	N - Other products of microtechnological equipment and the manufacture of devices (instruments, systems) with microtechnological parts or systems (e.g. computers, different instruments and devices, consumer electronics, etc.)
List of R&D of AS CR workplaces	Institute of Scientific Instruments of AS CR				●	●	●	●	●	●					
	Institute of Radio Engineering and Electronics of AS CR	●				●				●			●	●	
	Institute of Physics of AS CR	●			●	●		●		●			●	●	
	Institute of Analytical Chemistry of AS CR							●	●						
	Institute of Chemical Process Fundamentals of AS CR												●		
	J. Heyrovsky Institute of Physical Chemistry of AS CR										●		●		
	Institute of Plasma Physics of AS CR												●		
	Institute of Macromolecular Chemistry of AS CR					●			●				●	●	
	Institute of Biophysics of AS CR	●			●	●	●	●	●	●	●		●	●	
Workplaces of Universities	Charles University, Faculty of Mathematics and Physics, School of Physics	●											●		
	Charles University, Faculty of Science, Section of Chemistry	●			●								●	●	
	Masaryk University in Brno, Faculty of Science	●			●				●				●		
	Czech Technical University, Faculty of Mechanical Engineering				●	●			●	●			●	●	
	Czech Technical University, Faculty of Electrical Engineering	●	●		●	●			●				●	●	
	Czech Technical University, Faculty of Nuclear Sciences and Physical Engineering													●	
	Brno University of Technology, Faculty of Mechanical Engineering				●			●		●			●	●	
	Brno University of Technology, Faculty of Chemistry				●				●				●		
	Brno University of Technology, Faculty of Electrical Engineering and Communication	●				●	●	●	●				●		
	Palacky University, Faculty of Science												●		
	University of Pardubice, Faculty of Chemical Technology												●	●	

Index of R&D workplaces and the field of applications	Workplaces of Universities						
	Institute of Chemical Technology, Faculty of Chemical Technology	Institute of Chemical Technology, Faculty of Chemical Engineering	Technical University of Liberec, Faculty of Mechatronics and interdisciplinary engineering studies	Technical University of Liberec, Faculty of Mechanical Engineering	University of West Bohemia, Faculty of Applied Sciences	University of West Bohemia, Faculty of Electrical Engineering	Jan Evangelista Purkyně University, Institute of Science
A - Semiconductor and parts for microelectronics	●		●			●	
B - Communications microsystems							
C - MEMS, MOEMS			●				
D - Micro-scale technologies (mechanical micromachining, lithography, and chemical and other technologies)	●				●		
E - Micro sensors	●	●	●				●
F - Manufacturing equipment for microtechnologies and their parts							
G - Microanalytical equipment, its parts, and analytical methods	●						
H - Microsystems for the use in biotechnology and medicine						●	●
I - Metrology			●			●	
J - Microchemical systems							●
K - Microthermal systems							
L - Materials for microtechnologies (particles, layers, composites, etc.)	●		●	●	●	●	●
M - Optics and optoelectronics	●		●				
N - Other products of microtechnological equipment and the manufacture of devices (instruments, systems) with microtechnological parts or systems (e.g. computers, different instruments and devices, consumer electronics, etc.)							

Annexes No. 2 and 3.

Index of large companies (over 250 employees), products and applicatíons	A - Semiconductor and parts for microelectronics	B - Communications microsystems	C - MEMS, MOEMS	D - Micro-scale technologies (mechanical micromachining, lithography, and chemical and other technologies)	E - Micro sensors	F - Manufacturing equipment for microtechnologies and their parts	G - Microanalytical equipment, its parts, and analytical methods	H - Microsystems for the use in biotechnology and medicine	I - Metrology	J - Microchemical systems	K - Microthermal systems	L - Materials for microtechnologies (particles, layers, composites, etc.)	M - Optics and optoelectronics	N - Other products of microtechnological equipment and the manufacture of devices (instruments, systems) with microtechnological parts or systems (e.g. computers, different instruments and devices, consumer electronics, etc.)
AEG components, s.r.o.	●													
ALPS Electric Czech, s.r.o.														●
ASUS Czech s.r.o.														●
ASUsTek COMPUTER														●
AVX Czech Republic, s.r.o.	●													
BRISK Tábor, a.s.					●							●		
Celestica Kladno, s.r.o.														●
Celestica Ráječko s.r.o.														●
Connaught Electronics /CZ/, spol. s.r.o.					●									
EPIQ, spol. s.r.o.														●
ELTES CZ, s.r.o.	●													
EPCOS, s.r.o.	●											●		
FIC CZ, s.r.o.														●
Foxconn CZ, s.r.o.														●
Cherry, spol. s.r.o.					●									
Infineon Technologies, s.r.o.													●	
L.G.Philips Displays Czech Republic, s.r.o.														●
Panasonic Mobile & Automotive Systems Czech, s.r.o.														●
METRA Blansko, a.s.									●					●
ON SEMICONDUCTOR CZECH REPUBLIC, a.s.	●				●							●		
OPTREX Czech, a.s.	●													
Panasonic AVC Networks, s.r.o.	●													●
Polovodiče, a.s.	●											●		●
SAFINA, a.s.												●		
Saint-Gobain-Advanced Ceramics, s.r.o.												●		
STROM telecom, s.r.o.		●												
Tatung Czech, s.r.o.														●
TCT, a.s.														●
TEMOS Tools, a.s.									●					
Tesla, a.s.				●										●
Tesla Blatná, a.s.	●			●									●	
Tesla Jihlava, a.s.	●				●									●
TSE, spol. s.r.o.		●						●						●
TTC Holding		●												
Tyco Electronics Czech, s.r.o.	●													
VDO Česká republika, s.r.o.					●									●
Vishay Electronic, spol. s.r.o.	●													

Index of small and medium enterprises (under 250 employees), products and applications	A - Semiconductor and parts for microelectronics	B - Communications microsystems	C - MEMS, MOEMS	D - Micro-scale technologies (mechanical micromachining, lithography, and chemical and other technologies)	E - Micro sensors	F - Manufacturing equipment for microtechnologies and their parts	G - Microanalytical equipment, its parts, and analytical methods	H - Microsystems for the use in biotechnology and medicine	I - Metrology	J - Microchemical systems	K - Microthermal systems	L - Materials for microtechnologies (particles, layers, composites, etc.)	M - Optics and optoelectronics	N - Other products of microtechnological equipment and the manufacture of devices (instruments, systems) with microtechnological parts or systems (e.g. computers, different instruments and devices, consumer electronics, etc.)
2N telekomunikace,a.s.		●												
AEV,spol. s r.o														●
Aseko, spol. s r.o.					●									
Audio Vaic,s.r.o.	●													
AVIKO Praha s.r.o.						●			●				●	
Awos, s.r.o.														●
Barco, spol.s.r.o.					●									●
Barco Manufacturing, s.r.o.	●													
BD Sensors, s.r.o.							●							●
Befra-Electronic, s.r.o.														●
BVT Technologies, a.s.					●			●		●				
Carl Zeiss spol.s.r.o.							●	●					●	
C-com, s.r.o.		●										●		●
CRYTUR, s.r.o.												●	●	
CUBE CZ, s.r.o.	●													●
CZ-elektronika, s.r.o.														●
Če Me Bo, s.r.o.														●
Delong Group							●	●						●
ELCERAM, s.r.o.												●		
ELIS Plzeň, a.s.														●
Elmarco, s.r.o.						●								
ELMET, spol. s.r.o.														●
ELTON hodinářská, a.s.														●
ESY, s.r.o.														●
FEI Czech Republic, s.r.o.							●	●						
GeneAge Technologies, a.s.								●						
GEN-TREND, s.r.o.								●						
Goldcard, s.r.o.														●
Harlingen, s.r.o.	●													
HC electronics, s.r.o.	●													
Hokami CZ, s.r.o.														●
HVM Plasma, s.r.o.						●						●		
IMA, s.r.o.		●												●
Incline Global Technology Services (Czech), s.r.o.														●
Krystaly Hradec Králové, a.s.												●		
Laird technologies	●											●		
LAMBDA Praha, s.r.o.								●						

Index of small and medium enterprises (under 250 employees), products and applications	A - Semiconductor and parts for microelectronics	B - Communications microsystems	C - MEMS, MOEMS	D - Micro-scale technologies (mechanical micromachining, lithography, and chemical and other technologies)	E - Micro sensors	F - Manufacturing equipment for microtechnologies and their parts	G - Microanalytical equipment, its parts, and analytical methods	H - Microsystems for the use in biotechnology and medicine	I - Metrology	J - Microchemical systems	K - Microthermal systems	L - Materials for microtechnologies (particles, layers, composites, etc.)	M - Optics and optoelectronics	N - Other products of microtechnological equipment and the manufacture of devices (instruments, systems) with microtechnological parts or systems (e.g. computers, different instruments and devices, consumer electronics, etc.)
Letecké přístroje, s.r.o.					●									●
LISS, a.s.				●										
M.A.G. Galvanochemie, a.s.												●		
MEGA, a.s.								●		●				
Mesing, spol.s.r.o.									●					
MESIT PCB, spol. s.r.o.														●
MEV, s.r.o.														●
Mikroelektronika, spol. s.r.o.														●
Mikro-sensor, spol. s.r.o.					●				●					
Mikro Tek s.r.o.	●													●
MIKROTEL, s.r.o.		●												●
MITE Hradec Králové, s.r.o.														●
Mitsubishi Electric Automotive Czech, s.r.o.														●
Monokrystaly, s.r.o.							●	●						
MTEL Communications, s.r.o.													●	●
OPTAGLIO, s.r.o.				●										●
OPTOKON Co, Ltd.													●	
PCB Benešov, a.s.														●
PIVOT, a.s.						●								
Pragoboard, s.r.o.				●										●
RealTime Technologies, s.r.o.														●
Reflex, s.r.o.							●						●	●
SHM, s.r.o.												●		
SPEEL Praha, s.r.o.														●
STARMANS Electronics, s.r.o.							●		●					●
STROBOS, s.r.o.														●
SVM Microwaves, s.r.o.		●					●							●
TECO, a.s.														●
TESCAN, s.r.o.							●	●						
Tesla Tech, s.r.o.														●
TESLA V.T. MIKROEL, s.r.o.														●
Unicontrols, a.s.		●					●							
UNIS Brno, s.r.o.														●
UVB Technik, s.r.o.									●					
VAKUUM Praha, spol. s.r.o.							●							
Wendell Electronics, a.s.														●