ANNUAL REPORT

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Department of Microelectronics
Faculty of Electrical Engineering
Czech Technical University in Prague
Czech Republic

CONTENTS:

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Edited by Pavel Kulha (February 2011)

FOREWORD

The Department of Microelectronics belongs to The Faculty of Electrical Engineering (FEE) that is one of the six faculties forming the Czech Technical University in Prague (CTU in Prague). The roots of CTU in Prague can be followed as far back as the year 1705, when Christian Josef Willenberg (1655 - 1731) wrote a letter to Emperor Leopold I. in Vienna seeking permission to begin public teaching of engineering sciences. This was granted by a decree of Emperor Josef I (successor to Leopold I.) on 18 January 1707. For these reasons, the priority of CTU to be the first technical school at university level in the world is usually claimed for.
The Department of Microelectronics has been established in January 1977. During the past 28 years more than 1000 students graduated in the branch of Microelectronics and nearly 50 Ph.D and 5 DrSc. degrees have been awarded. Five persons from the Department staff became professors and 14 Associate Professors. The Department offers the B.Sc., M.Sc. and Ph.D. degrees in Electronics.

The Department maintains international co-operation with many universities, research laboratories, and institutes in the Europe. This is in connection with the LEONARDO and SOCRATES Programmes, EUROPRACTICE projects, the NATO Science for Peace programme, and the Framework Programmes of the European Community.

The Department gives a high priority to collaborative research with industry. The donation from Cadence is being used to continue the education of IC design at industrial level. Several domestic electronic factories were supported by R&D works from the Department this year.

This brochure is the 21st annual review of our Department. The content of this report emphasises our effort for continuing the close association of teaching, research and co-operation with external subjects at both national and international levels.

Prague
February 2011

Pavel Kulha
Editor

STAFF OF THE DEPARTMENT

Head of the Department: M. Husák, M.Sc., Ph.D.Deputy:
J. Foit, M.Sc., Ph.D.

Professors:	M. Husák, M.Sc., Ph.D.
	J. Kodeš, M.Sc., Ph.D., DrSc.
	(Emeritus Professor)
	J. Vobecký, M.Sc., Ph.D., DrSc.
Associate Professors:	Z. Burian, M.Sc., Ph.D.
	J. Foit, M.Sc., Ph.D.
	P. Hazdra, MSc., Ph.D.
	J. Vaníček, M.Sc., Ph.D.
	J. Voves, M.Sc., Ph.D.
Assistant Professors:	A. Bouřa, M.Sc.
	J. Jakovenko, M.Sc., Ph.D.
	V. Janíček, M.Sc.
	V. Jeřábek, M.Sc., PhD.
	L. Jirásek, M.Sc., Ph.D.
	P. Kulha, M.Sc. PhD.
	V. Komarnickij, M.Sc., Ph.D.
	A. Krejčiřík, M.Sc., Ph.D.
	A. Laposa, M.Sc.
	J. Novák, M.Sc. Ph.D
	V. Prajzler, M.Sc., Ph.D.
	T. Teplý, M.Sc.
	T. Vítek, M.Sc.
	V. Záhlava, M.Sc., Ph.D.
Ph.D. students:	L. Farský, M.Sc.
	J. Frolec, M.Sc.
	O. Harwot, M.Sc.
	M. Janoušek, M.Sc.
	J. Kroutil, M.Sc.
	M. Kubař, M.Sc.
	M. Majer, M.Sc.
	M. Mašek, M.Sc.
	J. Scheirich, M.Sc.
	Z. Šobáň, M.Sc.

SUPPORT STAFF

Department Secretary and Administration	R. Burianová
Teaching Laboratories:	L. Kafka
Technical Service:	M. Horník

ABOUT THE STAFF

Miroslav Husák was born in Kladno in 1953. He graduated in Radioengineering from FEE-CTU in Prague in 1978. Ph.D. in 1985, Assoc. Professor in 1997, Full Professor in 2000. Manager of Microsystems Group. Author or co-author 6 lecture notes and more than 200 scientific and technical papers. Research in the field of microsytems and integrated sensor systems. Teaching the courses Sensor systems, Power Suppliers in Electronics, Electronic Security Systems and Microsystems. Supervisor of Electronics branch (Master and Ph.D. study).

Jiří Kodeš was born in 1932. He received MSc., Ph.D., and D.Sc. degrees in electronics, semiconductor physics and microelectronics from the CTU in Prague in 1956, 1963 and 1990, resp. At present, he is Full Professor at the Department. His area of research includes electronic transport in semiconductors and quantum electronics devices. He is the author or co-author of numerous technical papers in journals and conference proceedings. He has written several textbooks for students.

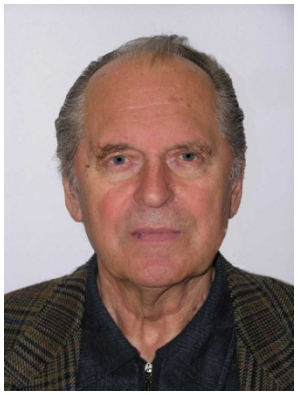
Jan Vobecký - MSc. 1981, Ph.D. 1988, Assoc. Professor 1992, DrSc. 1999, Full Professor 2000 – all from FEE-CTU in Prague. Visiting fellow: University of Uppsala (1988, 1989-90), MOTOROLA Toulouse (1993). Research: High-power devices - design & technology. Author and reviewer of numerous scientific papers, H-index = 8, 37 SCI papers, 161 SCI citations, 2 patents granted, 12 patent applications, 1 textbook, 9 printed lectures. Member of Scientific Board FEE-CTU in Prague and Academy of Sciences Czech Rep. Senior Member IEEE, Adcom member SRC EDS IEEE.

2007- now with ABB Switzerland Ltd. Semiconductors, Lenzburg, Product Management & Technology Group.

Zdeněk Burian was born in 1944. He graduated from the FEE-CTU in 1966. In 1975 he received PhD. degree. He is the author of 35 technical papers, 10 printed lectures and he owns 7 technical inventions. He is Assoc. Professor and gives lectures on optoelectronics. He is working in the field of integrated optics and planar optical waveguides. He researched the optical waveguides in silica in University of York, U.K.. Member of EOS and Czech Society of Photonics.

Julius Foit was born in 1932. He received MSc., PhD. and Ass. Prof. degrees in Radar Engineering, Colour TV Eng. and Multiphase Signal Processing from the CTU in Prague in 1954, 1961 and 1978, resp.. Dean of the Faculty in the University of Maiduguri, Nigeria in 1987-1989 and B. Tech. Programme Coordinator in the University of Zimbabwe, Harare, in 1990-1993. Currently, he is Associate Professor in the Dept. He is the author of many papers, several monographs and textbooks for students. He is a Fellow of ZIE and Past-President of Rotary Int.

Pavel Hazdra was born in 1960. M.Sc. and Ph.D. in Microelectronics from FEE-CTU (1984, 1991), Assistant (1987), Associate (1996) and Full Professor (2010), Vice Dean of the FEE CTU (2006-7). In 1988, 1992, and 1993 4 visiting fellow at the University of Surrey, Hull, and Lund, resp. Research on defects in semiconductors, quantum structures and their characterization. Manager of the Electron Device Group. More than 200 scientific and technical papers. H index = 10, 45 SCI papers, 194 SCI citations, 2 patents granted. SM IEEE and vice chairman of the IEEE MTT/AP/ED/EMC Chapter in the Czech Republic.



František Vaníček was born in 1936. He graduated in Radioelectronics from the FEE-CTU in Prague, in 1960. PhD. in 1972 and Assoc. Professorship in 1978. From 1972 to 1975 he gave lectures in MTC Kahira, Egypt, and from 1981 to 1983 in HIE Beni Walid, Lybia. He is the author of 15 techn. papers and 10 printed lectures. He is teaching in the area of semiconductor structures and their models. The winter term of 1992 and 1993 he spent in KIHWV Ostende in the frame of TEMPUS programme.

Jan Voves was born in Prague in 1960. MSc. and RNDr. degree in Physical Electronics and Optics from the Charles' University in Prague in 1984. Since 1984, Research Assistant in the Department (characterisation of ion implanted doping profiles in semiconductors). From 1987 and 1996, Assistant and Assoc. Professor, resp. Ph.D in 1993. Research in the device physical modelling (Monte Carlo Method). Author of about 30 technical papers and 3 printed lectures. Member of the IEEE.

Jan Formánek was born in Most in 1985. He graduated in Microelectronics from the FEE-CTU in Prague in 2010. Since September 2010 he is a PhD student at the Department of Microelectronic. He is a member of the Microsystems group. Since November 2010 he is part-time research fellow in the Department. His work is focused on analog integrated circuit design and thermoelectrical simulations of electronic components.

Jiří Jakovenko born 1972, Prague. He graduated in Microelectronics from FEE-CTU, Ph.D. from FEE-CTU in 2004. Member of Microsystems group. Research: MEMS design and modeling. In 1998 he spent 4 months in Hogeschool Gent in the frame of TEMPUS programme. Author of many scientific and technical papers. Since 1999 Assistant Professor at the Dept. Education: Microelectronics, IC Design, Design of VLSI, Practice of IC design, Electronics.

Vladimír Janíček was born in 1974 in Most. He graduated in Microelectronics from the FEE-CTU in Prague and he belongs to the Microsystems group. His Ph.D. research is in the field of polymer electronics power supply. At present, he is IT manager of the Department

Vítězslav Jeřábek born 1951. 1975: MSc. from FEE-CTU in Prague. 1987: PhD. in Optoelectronics. 1976–91: TESLA Research Institute, Prague. 1981: Optoelectronics Division, dynamics and modelling of optoelectronics devices & broad band optoelectronic modules. 1991–98: Head R&D lab. Dattel Ltd. - integr. optoelectronics modules and systems. Since 1999: teaching technology of optics and optoelectronics components and systems for transmission and processing of information. Author of 35 technical papers, 2 printed lectures and 3 patents, Member IEEE, Committee member of IEE in the Czech Republic.

Lubor Jirásek was born in Prague in 1953. He graduated from the FEE CTU in Prague, in 1978. He received PhD. degree in Electronics in 1983. From 1978 to 1983 he was working as a Research Fellow in the area of high-power devices. He is author of 7 technical papers and 3 printed lectures. He is teaching in the area of semiconductor devices and solid-state physics. Presently, he is responsible for the curriculum of the Department.

Vladimir Komarnitskij was born in 1980 in Ukraine. In 2002, he graduated Chernivtsy National University, Ukraine, from the specialization physics electronics. He received Ph.D. degree in Electronics from FEE-CTU in 2006. He is currently working as a postdoc in the Electron Device Group. His research is in the field of radiation defects in semiconductors and characterization of quantum structures.

Alexandr Krejčiřík was born in 1947. He graduated in Electrotechnology from the Faculty of Electrical Engineering, CTU in Prague, in 1971. He received PhD. degree in Mathematics and Physics – branch Semiconductors. He is the author of 10 technical papers, 21 printed lectures and 12 textbooks. He is teaching courses on Electronics, Power supplies in Electronics and Design of Power Supplies.

Pavel Kulha was born in Písek in 1978. He graduated in Microelectronic from the FEE-CTU in 2002. He received Ph.D. degree in Electronics from FEE-CTU in 2009. He is working as assistant professor since September 2004. His work is concentrated on microsensors and microsystems for high temperature applications.

Petr Mašek was born in Mariánské Lázně in 1986. He graduated in Microelectronics from the CTU-FEE in Prague in 2010. Since 2010 he is a PhD student at the Department of Microelectronic. He is a member of the Microsystems group. His work is focused on detection of ionisation radiation and development of the new detector systems.

Jan Novák was born in Prague in 1973. He graduated in Microelectronics from FEE-CTU, Ph.D. from FEE-CTU in 2006. Member of Microsystems group. Research: Electromagnetic compatibility of integrated circuits and microsystems. Since 2001 he is an Assistant Professor at the Department. He is teaching Electronics, PCB Design and IC Design. He is finance manager of the Department.

Václav Prajzler was born in Prague, the Czech Republic in April 10th 1976. In 2001 he graduated from the Faculty of Electrical Engineering at the Czech Technical University in Prague at Department of Microelectronics. Since 2005 he has been working at the Czech Technical University in Prague, Faculty of Electrical Engineering, Department of Microelectronics as a research fellow. In 2007 he obtained the PhD degree from the same university. His current research is focused on design of the new photonics structures such as optical microring resonators and passive photonics devices. Research is also focused to investigation properties of the polymer materials doped with rare earth ions.

Vít Záhlava was born in Prague in 1965. He graduated in Microelectronics from the FEE-CTU in 1988. Ph.D. degree in 1994. He is teaching Electronics and PCB design. Active in EMC on PCB, design, application and testing. He is a member of the Academic Senate of the Faculty. He is the author of 4 textbooks, several printed lectures for students, and technical papers on power devices.

Adam Bouřa Adam Bouřa was born in Ostrava in 1980. He graduated in Microelectronics from the FEE-CTU in Prague in 2004. Since 2004 he is a PhD student at the Department of Microelectronic and member of the Microsystems group. His work is concentrated on wireless sensor systems. Since January 2005 to February 2006 he was part-time research fellow and since February 2006 he is an assistant professor at the Department. He is teaching Electronics, Electronic Devices and Structures, Sensors for Electronic and Sensors for Medicine.

Jiří Kroutil was born in Tábor in 1980. He graduated in Microelectronics from the CTU-FEE in Prague in 2005. Since 2005 he is a PhD student at the Department of Microelectronic. He is a member of the Microsystems group. His work is focused on inteligent microsystem structures.

Miloslav KUBAŘ was born in 1981. He gets his MSc. degree in electronics from Czech Technical University (CTU), Prague, in 2007. He worked with STMicroelectronics in 2006 as analog IC designer. He is currently working toward Ph.D. in microsensor signal processing at CTU. Topic of his thesis is Design and optimization of the linear low-power regulators for integrated circuits. He also works with Asicentrum s.r.o from 2007 as analog IC designer.

Alexandr Laposa was born in Pardubice in 1978. He graduated in Automation and Computer Science from Faculty of Mechanical Engineering from Brno University of Technology. He is working towards his Ph.D. in Microsystems Group. His work is concentrated on inteligent microsystem structures.

Tomáš Teplý was born in Chrudim in 1979. He graduated in Microelectronics from the FEE-CTU in Prague in 2005. He is working towards his PhD in the Microsystems group. His work is concentrated on simulation and optimization of microsystems. Since October 2005 he is part-time research fellow at the Department.

Tomáš Vítek was born in Opava in 1980. He graduated in Microelectronics from the FEE-CTU in Prague in 2005. Since March 2005 he is a PhD student at the Department of Microelectronic. He is a member of the Microsystems group. His work is focused on microsystems and security systems. Since October 2005 he is part-time research fellow in the Department.

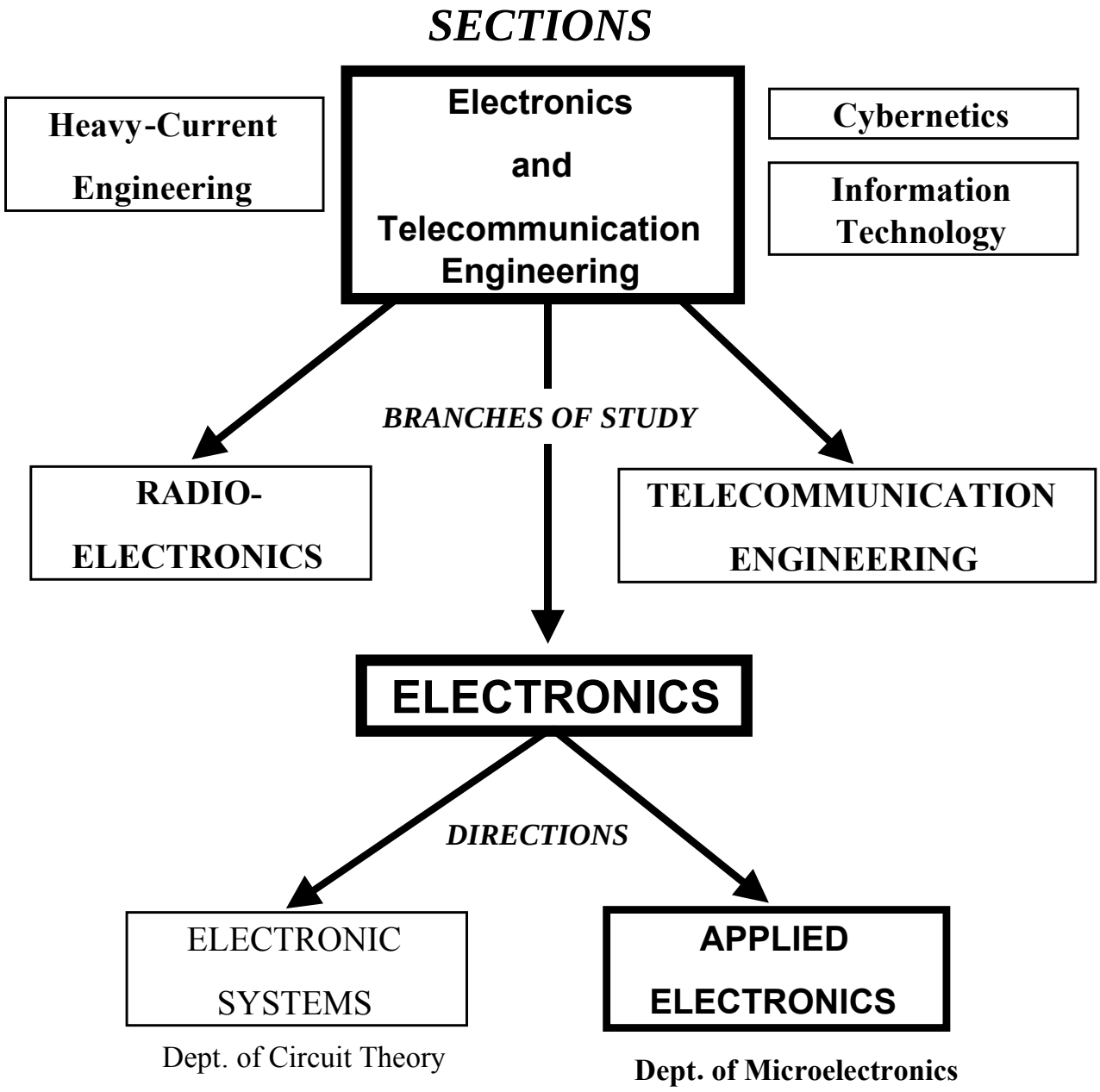
Renáta Burianová was born in Prague in 1960. She graduated from grammar school in 1979 and Secondary school for librarians in 1981. She joined the Department of Microelectronics in September, 1981. From that time she has been in charge of administrative work of the Department.

Lubomír Kafka was born in 1943. He attended the grammar school from 1958 to 1961. From 1961 to 1963 he studied the secondary school on "Mechanic of electronic equipments". In 1965 he joined the CTU in Prague as a technician. At present, he is working as a technician in the Department. He is responsible for teaching laboratories. He is engaged in mechanical and electronic service.

Miroslav Horník was born in Prague in 1946. He graduated in 1966 at a Secondary school specialized in Machinery engineering in Prague. He joined CTU Prague, then the Institute of Physics, Czechoslovak Academy of Science and, nowadays, he is working in the Department as a technician. He provides repair and service of miscellaneous tools and equipments.

UNDERGRADUATE TEACHING

Organization of study at the Faculty of Electrical Engineering



BRANCH OF STUDY ELECTRONICS

The objective of the electronic branch of study is to educate electrical engineers competent to solve problems concerning the wide spectrum of the structure of electrical industry and also extending to the field of information and computing technology, ecology, health care, mechanical engineering, robotics, etc.

The study involves the necessary theoretical introduction into subjects that provide general education for an electrical engineer which is followed by specialized courses. As to specialized orientation, the stress is laid on electronic components, semiconductor structures, digital and analog electronic circuits, microelectronics, application specific integrated circuit design, microcomputers, signals and electronic systems, sensors, sensor systems, design of electronic equipment, integrated and coherent optics, radiation sources and detectors, applications of optoelectronics and telecommunication systems. The study of the applied electronics and electronic systems aims to prepare engineers who are able to solve problems of the applications of integrated circuits and of the special electronic structures and systems, as well as the electronic instrumentation design. The students master the digital signal processing methods and the implementation of algorithms in the special processor systems.

The optional subjects in the higher terms provide the students an opportunity of individual choice of their further specialization emphasizing the applications of electronics and optoelectronics.

The topics of lectures, laboratory and seminar exercises have been selected so that a student can master the reported stuff perfectly also in practice. The Department of Microelectronics endeavors to give the students, especially those with excellent results, the possibility of satisfying their professional ambition home, as well as abroad. The graduates are also offered a possibility of further postgraduate (Ph.D) studies. We believe that the graduates of our specialization will find good jobs in the industry of developed countries.

COURSES DELIVERED BY THE DEPARTMENT
In summer semester 2009/2010

Courses in Czech – Bachelor Study Program

Course Code	Course Name	Lectures and exercises in hours per week
New curriculum		
A0B34PPN	Principles and Rules of Electronic Design	2+2
A2B34ELP	Electron Devices	2+2
Old curriculum		
X34BAP	Bachelor Project	0+5
X34ELE	Electronics	2+2
X34ESS	Electronic Devices and Structures	2+2
X34FOT	Photonics	2+2
X34NZE	Design of Power Supplies for Electronics	2+2
X34SEE	Sensors in Electronics	2+2

Course in Czech – Master Study Program

Course Code	Course Name	Lectures and exercises in hours per week
New curriculum		
A2M34MIM	Microsystems in Multimedia	2+2
A2M34MST	Microsystems	2+2
A2M34NAN	Nanoelectronics and Nanotechnology	2+2
A2M34NIS	Design of Integrated Systems	2+2
A4M34ISC	Integrated System on Chip	2+2
A5M34ELE	Electronics	2+2
Old curriculum		
X348MS	Microsensors and Microsystems	2+2
X34APS	Advanced Electronic Devices	2+2
X34DIP	Diploma Project	0+14
X34EZS	Electronic Security Systems	2+2
X34FPV	Photonic receivers and transmitters	2+2
X34MIT	Microcontroller Systems	2+2
X34MSY	Microsystems	2+2
X34NSE	New Trends in Electronics	2+2
X34PPN	Principles and Rules of Electronic Design	2+2
X34SIE	Synthesis of Integrated Electronic Circuits	2+2

Courses in English

Course Code	Course Name	Lectures and exercises in hours per week
New curriculum		
AE2B34ELP	Electron Devices	2+2
AE2M34MIM	Microsystems in Multimedia	2+2
Old curriculum		
XE34ESS	Electronic Devices and Structures	2+2
XE34NZE	Design of Power Supplies	2+2
XE34TCA	TCAD	2+2
XE34SIE	Synthesis of Integrated El. Systems	2+2

Courses for vocational students

Course Code	Course Name	Lectures and exercises in hours per week
New curriculum		
AD2B34ELP	Electron Devices	2+2
AD2M34MST	Microsystems	2+2
AD2M34NAN	Nanoelectronics and Nanotechnology	2+2
AD2M34NIS	Design of Integrated Systems	2+2
Old curriculum		
XD34BAP	Bachelor Project	0+15
XD34ELE	Electronics	14+6
XD34ESS	Electronic Devices and Structures	14+6
XD34SEE	Sensors in Electronics	14+6
XD34FOT	Photonics	14+6

COURSES GIVEN BY THE DEPARTMENT
In winter semester 2010/2011

Courses in Czech – Bachelor Study Program

Course Code	Course Name	Lectures and exercises in hours per week
New curriculum		
A0B34PPN	Principles and Rules of Electronic Design	2+2
A2B34IN	Individual Project	2+2
A4B34EM	Electronics and Microelectronics	2+2
Old curriculum		
X34BPJ	Semester Project	2+2
X34BAP	Bachelor Project	0+5
X34MPC	Microcontrollers	1+2
X34NZE	Design of Power Supplies for Electronics	2+2

Courses in Czech – Master Study Program

Course Code	Course Name	Lectures and exercises in hours per week
New curriculum		
A0M34EZS	Electronic Security Systems	2+2
A0M34NFO	Design of Photonic Circuits	2+2
A0M34NNZ	Design of Power Supplies for Electronics	2+2
A2M34BP3	Safety in Electronics	2+2
A2M34IND	Individual Project	0+4
A2M34SIS	Integrated System Structures	2+2
A5M34EZS	Electronic Security Systems	3+1
Old curriculum		
X34NII	Design of Integrated Circuits for Informatics	2+2
X34NNZ	Design of Power Supplies for Electronics	2+2
X34POP	Practice of Optoelectronics	2+2
X34BMS	Biomedical Sensors	2+2
X34PMI	Individual Project	2+2
X34DIP	Diploma Project	0+4
X34PPN	Principles and Rules of Electronic Design	2+2

Courses in English

Course Code	Course Name	Lectures and exercises in hours per week
New curriculum		
AE2B34IN1	Individual Project	2+2
AE2M34SIS	Integrated System Structures	2+2
AE4B34EM	Electronics and Microelectronics	2+2

Courses for vocational students

Course Code	Course Name	Lectures and exercises in hours per week
New curriculum		
AD0M34EZS	Electronic Security Systems	2+2
AD2B34IN1	Individual Project	0+4
AD2M34BP3	Safety in Electronics	2+2
AD2M34NAN	Nanoelectronics and Nanotechnology	2+2
AD2M34PMI	Individual Project	0+4
AD2M34SIS	Structures of Integrated Systems	2+2

A BRIEF DESCRIPTION OF COURSES DELIVERED BY THE DEPARTMENT

Electronics, BSc

Lectures given by J. Foit and V. Záhlava

Semiconductors. PN junction, diodes, Schottky diode. Rectifiers. Bipolar transistors, biasing circuits. JFET and MOSFET, biasing circuits. Small signal amplifier, power amplifier. Switching circuits. Power amplifier classes. Thyristor, latch-up. Operational Amplifiers – negative and positive feedback, basic circuits. Optoelectronics – LED, laser, photodiode, phototransistor, photoresistor. Introduction to digital technique – CMOS, LSTTL.

Electron Devices, BSc

Lectures given by P. Hazdra

This course introduces the basic theory, principles of operation and properties of electron devices. Physical principles of operation, device structures and characteristics are explained together with adequate models for small- and large-signal. Basic applications in analogue and digital electronics are examined. In seminars and labs, students are introduced to basic principles of device simulation, measurement of device characteristics and extraction of device parameters. Operation of electron devices in electronic devices is then analyzed using the PSpice simulator.

VLSI system design, MSc

Lectures given by P. Hazdra

Course introduces students to basic principles of design, synthesis and verification of very large scale integration (VLSI) systems and systems on chip. Students become acquainted with basic building blocks, architectures and design principles, which are used for realization of complex integrated systems, design methodology and system synthesis. Students will also learn verification strategy, test design and analysis. In seminars and labs, the hardware description languages (VHDL, Verilog) will be explained and used for practical design, synthesis and testing of a system on chip.

Photonics, BSc

Lectures given by Z. Burian

The major aim of these lectures is to explain the principles and using of the main parts of modern optical systems, both from the theoretical and application point of view. Measurement methods for optoelectronics are presented. The part of lectures is devoted to optical display structures, optical processors and to the image processing.

Power Supplies in Electronics, BSc

Lectures given by M. Husák, F. Vaníček

Rectifiers. Stabilisers - parametric, with continuous control. IC voltage regulators. Fly-back converter. Forward converter. Push-pull converter, double forward converter. Monolithic regulators. EMC. Over current protection. Over voltage, under voltage, output reverse voltage protection. Overload and thermal protection. Batteries, solar battery, accumulator, chargers. References.

Microcontrollers, BSc

Lectures given by T. Teplý

Microchip PIC18F252 family. I/O tasks, programmable peripheral ICs. Development and debugging tools. Design and programming of instruments and systems based on single-chip computers. Individual students' projects.

Design of Integrated Circuits, BSc

Lectures given by J. Jakovenko

Basic functional structures of ICs. Passive and active elements. Technological process. Bipolar and unipolar structures. Logic integrated circuits, VLSI circuit systems. Analogue integrated circuits. Design of vertical structure, layout, design rules. System of IC process quality control. IC functional and parametric testing, test structures, yield and reliability.

Optoelectronics I, BSc

Lectures given by V. Jeřábek

Basic principles of optoelectronics. Planar and fiber optical waveguides. Semiconductor lasers and LEDs. Semiconductor light detectors. Structures for distribution and harnessing of optical radiation. Optoelectronic processors. Optical communication systems. Optical amplifiers. Display devices. Optical memories. Optical fiber sensors. Integrated optical and photonic structures.

Sensor Systems, BSc

Lectures given by M. Husák

Sensor - classification, materials, production. General characteristics - static and dynamic parameters, errors, noise, linearisation, calibration. Microelectronic sensors materials, physical principles, design, integration. Temperature sensors, pressure sensors, SAW sensors, optoelectronic sensors, fibre optic sensors. Radiation sensors. Magnetosensors. Chemical sensors, biosensors. Humidity sensors. Flow meters. Level sensors. Sensor signals processing. Smart sensors. Application of sensors.

Semiconductor Electronics, BSc

Lectures given by J. Voves

Electronic properties of semiconductors based on their crystal structure. Transport and statistics of electrons and holes in equilibrium and non equilibrium semiconductor. Properties of basic semiconductor structures (PN junction, heterojunction) based on band structure analysis. Systematic derivation of semiconductor devices characteristics (diode, BJT, MOSFET, JFET, laser) with special emphasis on non ideal effects and extracted circuit models. Essential progress trends.

Integrated System Structures, MSc

Lectures given by J. Jakovenko

Importance of ICs. Economic aspects of IC. Design methodologies: gate arrays, standard cells and functional blocks, full custom design. Design hierarchy: behavioural description, logic and electric design, simulation, layout capture and verification. CAD tools for IC design: HDL, front end tools, simulators, layout editors, structural synthesis, silicon compilers. IC testing.

Sensors in Security Systems, MSc

Lectures given by M. Husák

Security, safety and multi-channel systems. Dynamic analysis and optimisation. Signal interference and system internal noise. Input quantities. Analog and digital signal processing, conversions. Signal representation and sensor signal code. System calibration. Communication in system, interface. Output unit - communication, indication, registration, protection, switch, local and remote control, actuators.

Nanoelectronics and Nanotechnology, MSc

Lectures given by J. Voves

The subject is oriented on the present nanotechnologies in the connection with their electronic, photonic and spintronic applications. Quantum theory basics are used to explain the effects observed in nanostructures. Basic nanoelectronic structures are described with their possible applications. Modern computer methods and models, which are able to simulate the operation of nanoelectronic structures and which are the important tools for their design and optimisation, are studied.

Application of Power Devices, MSc

Lectures given by L. Jirásek

Static and dynamic processes of power structures in forward, blocking and reverse mode of operation. Power diodes, BJTs, thyristors and special thyristor structures, field controlled power devices, HF and HV devices, power ICs, characteristics and features. Packaging and cooling, transient thermal impedance. Principles of application in power circuits, basic trigger and application circuits.

Practice of IC Design I, MSc

Lectures given by J. Jakovenko

Main purpose of this course is to enable students to design their own integrated circuit. Students will work in groups (of 5 to 10 students) on the design project using industrial standard CAD tools (CADENCE, SYNOPSYS). Successful circuits could be fabricated via EUROPRACTICE project. The lectures will be concentrated in the first three weeks of the term and will be devoted to IC design methodologies, CAD tools, description of available libraries and design rules.

Desigh of photonic structures, MSc.

Lectures given by V. Jeřábek

Students will obtain practical skills with design of photonic devices and their applications in photonic systems. Students acquaint with BMP, FULL WAVE and TCAD programs. These software allowed design of optical structures and devices used for control and distribution of optical signals. Software TCAD is used for design of injection optical sources. Optoelectronic integrated circuits will be designed by ORCAD and WINMIDE software.

Applications of Modern Devices, MSc

Lectures given by J. Foit

Analog devices, optimisation. Interference of different types of signal transmission, optimisation. Rules for optimisation of large arrays, power distribution, interfacing. Mixed-mode devices. Diagnostics in ADC's and DAC's, minimising residual errors. Standards for interface buses, sensors, actuators, ergonomics. Processing of small and large signals, noise, insulation.

Design of Power Supplies, MSc.

Lectures given by A. Krejčiřík

This represents extension of the subject "Power Supplies in Electronics". The main field comprises Integrated circuits for SMPS (principles, design, verification.) Coils, transformers, regulators, synchronous rectifiers, resonance power supplies. Switcher CAD. Magnetic design Tool. Filter CAD. MicroPower Switcher CAD.

Principles and Rules of Electronic Design

Lectures given by V. Záhlava

Computer design of printed circuit boards (PCB). System OrCAD. Design rules for PCB according to EMC in analog, digital and power applications. Supply and grounding techniques. Technological processes and fabrication of PCB, classes of accuracy. Surface mount technology and devices, circuit layout process and soldering. Technological and design trends. Design of student PCB by use of PC in departments computer room.

Programmable Logic Devices

Lectures given by P. Hazdra

Programmable logic devices (PLD): types, principles, internal architecture, and production technologies. SPLDs (PAL, GAL, PLA), CPLD devices and field programmable gate arrays (FPGA): architecture of internal elements, interconnections, development systems, configuration and reconfiguration. Configurable Systems on Chip. PLD design usig VHSIC HDL (VHDL): synthesis, mapping and testing. Practical design of CPLD and FPGA using Xilinx ISE.

COURSES FOR PhD. STUDENTS (IN CZECH)

Programmable IC Design, PhD

Lectures given by P. Hazdra

IC's, reasons for integration, processes and methods of IC design. Custom IC's, programmable IC's. PICs with AND-OR matrices (PLD). Higher grade PLD-CPLD structures; architecture, logical blocks, interconnections. Programmable gate arrays (PGA) - principles, internal architecture. LCA-type PGA, "fine grain" structures. Tools for automated PIC design. Description of the PIC by a schematic diagram. The VHDL language for CPLD and PGA. Design of basic logic blocks in CPLD and PGA structures. Methods of PIC design, distribution to blocks. Data paths analysis, timing, testability. Advanced PICs: re-configurable and mixed-mode structures. PIC choice strategy and economics of PIC-based design.

Crystaloptics and Non-linear Optics

Lectures given by J. Čtyroký

Optical medium type classification. Single- and double-axis optical anisotropy. Chiral media. Propagation of planar waves, polarisation, phase and group velocity vectors. Energy balance and reciprocity. Reflection and refraction. Electro-optical and piezoelectric tensors. Theory and design of beam handling devices.

Integrated Optics

Lectures given by V. Jeřábek

Theoretical and technological principles of IO. Light propagation in dielectric waveguide structures. Methods of waveguide structures solution. Basic physical effects and interactions used for IO structures. Fabrication of dielectric waveguides and IO structures. Passive and dynamic waveguide devices. Non-linear devices. Semiconductor integrated optoelectronics.

Optical Radiation Detection and Detectors

Lectures given by Z. Burian

Electromagnetic radiation spectrum. Radiometric and photometric units. Detection of optical radiation. Ideal detector, internal and external photo-effect. Optical receivers, design principles, properties. Noise. Detectors based on external or internal photo-effect, on thermal phenomena and others. Solar cells, properties.

Advanced Power Semiconductor Devices and ICs

Lectures given by J. Vobecký

Physical and technological principles of advanced power devices. Trends of evolution. Parameters and applications of advanced devices. Bipolar structures. MOS structures. BiMOS structures. PN diodes. Schottky diodes. BJT transistors. DMOS and IGBT transistors. Thyristors, including GTO and MCT. Secondary breakdown theory and design rules. Smart-power devices. High voltage devices, applications.

Semiconductor Radiation Sources

Lectures given by Z. Burian

Stimulated emission in semiconductors, Homogeneous junction and heterojunction. Double heterostructure lasers. Waveguide resonators, DFB structures. Types and properties of lasers. Bistable and memory devices, switches. Non-coherent LEDs. Super-LEDs. Laser injection amplifiers. Applications and measurement of various types.

Technology of Optoelectronic Structures

Lectures given by V. Jeřábek

Preparation of optoelectronic materials and structures, diagnostic and testing methods. Fabrication of semiconductor waveguides, LEDs, lasers, photodetectors and QW structures. Design and fabrication of planar dielectric waveguide structures for distribution and harnessing of optical radiation. Measuring and testing methods. Properties of various structures, practical examples.

VLSI Structures and Technologies

Lectures given by J. Jakovenko

Functional structures of integrated circuits, unipolar and BiMOS structures. 3D structures, submicron technologies. Problems associated with dimensional reduction. Memory cells. Test structures. VLSI processes. New technologies. IC design, layout, design rules. Reliability and yield. Limitations in ICs.

Electrical Transport in Semiconductors

Lectures given by J. Voves

Electrons and holes in semiconductor crystals. Boltzmann transport equation, scattering. High field transport. Quantum transport, resonant tunneling. Single electron transport, Coulomb blockade. Ballistic transport. Transport in magnetic field, quantum Hall effect.

COURSES IN ENGLISH

Synthesis of Integrated Electronic Systems, MSc

Lectures given by P. Hazdra

Introduction to basic building blocks, architecture and design methodologies of advanced VLSI systems. Structure and design of digital and analogue integrated circuit subsystems. Integrated system description and synthesis using cell libraries and IP cores. Synchronization, power consumption and parasitics reduction issues. Testing and reliability of integrated systems. In seminars and labs, the hardware description language VHDL will be explained and used for practical design, synthesis and testing of a system on chip.

RESEARCH ACTIVITIES

The Department has continued in research activities through grants and contracts from the Ministry of Education of the Czech Republic, Grant Agency of the Czech Republic, and CTU in Prague. A significant part of research activities was supported by the Programmes of the Ministry of Education in the following fields in alphabetical order:

- Development, Reliability and Safety of Electro-Energetic Systems,
- Information and Communication Technology,
- Methods and Systems for Measurement of Physical Quantities and Data Processing,
- Trans-Disciplinary Biomedical Engineering Research.

The international projects were those of the Framework Programmes of the European Community.

In the field of research contracts the co-operation with Robert Bosch and Magneton took place.

The research activities of the Department are focused on Electron Devices, Optoelectronics and Microsystems as listed below in the order of their date of origin. These three directions constitute the organization scheme of research in our Department and are schematically shown below. This scheme is supplemented by a brief summary of activities of individual research groups and list of their members. This is followed by the description of relevant research projects of individual research groups. The list of contracts is given as well.

MICROSYSTEMS GROUP

Head of the Research Group: M. Husák

Members: J. Foit, J. Jakovenko, V. Janíček, L. Jirásek, P. Kulha, J. Novák, A. Bouřa, T. Vítek, T. Teplý, A. Laposa, J. Kroutil, M. Kubař, J. Scheirich, M. Majer, L. Farský, J. Formánek

Research Activities:

- Modeling of Temperature and Mechan. Behaviour of Microsystem Structures
- Design of Strain Gauge Sensors for High-Temperature
- Semiconductor Microsystem Structures
- Sensor Signals Processing and Wireless Transmission
- Sensor Control Systems
- Integrated Circuit Design

ELECTRON DEVICE GROUP

Head of the Research Group: P. Hazdra

Members: J. Vobecký, J. Voves, V. Záhlava, J. Kodeš, V. Komarnitskyy, J. Janoušek, Z. Šobáň, O. Harwot.

Research Activities:

- Quantum Devices and Nanostructures, Spintronics
- Device and Process Simulation
- Lifetime and Defect Engineering
- Ion Irradiation
- Power Devices and Integrated Circuits
- Current Injection Capability of Microcontroller Units
- Programmable Logic Devices
- PCB Design and EMC

OPTOELECTRONICS GROUP

Head of the Research Group: V. Jeřábek

Members: Z. Burian, V. Prajzler, K. Bušek, J. A. Arciniega

Research Activities:

- Preparation and Testing of Planar Waveguides
- Analysis, Preparation and Testing of Novel Planar Electro-Optic Structures for Distribution and Harnessing of Optical Radiation
- Analysis, Preparation and Testing of Novel Devices and Integrated Planar Electro-Optic Structures for Transmitting and Receiving of Opt. Radiation
- Modeling of Electro-Optic Structures
- Research toward the Integrated Optic Circuits for Measurement and Sensor Applications

RESEARCH PROJECTS

MICROSYSTEMS GROUP

MORGAN
Project leader: M. Husák
Project No. VG20102015015

MORGaN is an FP7 project which will address the need for new materials for electronic devices and sensors that operate in extreme conditions, especially high temperatures and high electric fields. It will take advantage of the excellent physical properties of diamond and gallium nitride (GaN) based heterostructures. The association of these two materials will give rise to the best materials and devices for ultimate performance in extreme environments.

INTELLIGENT MICRO AND NANO STRUCTURES FOR MICROSENSORS REALIZED WITH SUPPORT OF NANOTECHNOLOGY
Project leader: M. Husák
Grant No. GA102/09/1601

The project is targeted on research in the field of new types of microstructures with carbon diamond layers and promising materials from AIIIBV group, for using in industry, living environment protection, biomedicine and measurement systems. Nanocrystalline diamond layer are determined for integrated intelligent strain gauges capable work under very high temperatures. Entire part of the aims is to verify technological processes leads to successful realisation of such structures ideally on silicon substrates, mainly selective growth of diamond layers and doping. Research in the field of micro and nanostructures and their preparation for sensors is aimed to deposition of carbon composites, e.g. nanotubes and nanofibres. Research of piezoelectric AlGaN/GaN structures is determined for intelligent gas sensor based on SAW principle. Operating range of such sensor is up to 500 °C - 1000 °C.

INTEGRATED MICROSYTEM FOR ANALYSIS OF TOXIC GASES CONCENTRATION (MAK)
Project leader: M. Husák
Project No. VG20102015015

The goal of the project is to develop an intelligent miniaturised system for gas concentration analysis with variable multisensor matix.

ENIAC CSSL - CONSUMERIZING SOLID STATE LIGHTING
Project leader: M. Husák
Project No. 120219

LED (Light-emitting diodes) lamps are a fast emerging technology and many commercial products are now available for professional application, however there is rarely any LED retrofit products which meets all the expectations of consumers in terms of price, light output and other functionalities at the same time. The cosumerizing Solid State Lighting (CSSL) project aims to demonstrate affordable smart SSL light-sources for consumers via both technology and application routes. The proposed CSSL project works vertically across the entire value chain from LED die, lightsource, consumer luminaires, controls and dimmer to partnerships with utility companies in order to bring SSL retrofit product to European consumers with a substantial cost reduction.

DEVELOPMENT OF SMART DEVICES AND SYSTEMS IN THE FIELD OF MICROELECTRONICS, NANOELECTRONICS AND OPTOELECTRONICS
Project leader: M. Husák
Project No. SGS10/280/OHK3/3T/13

The project supports selected expert activities sold by doctoral and master students in the field of micro and nanostructures, microsystems and microsensors, chip integration, the use of new materials, including optoelectronic integrated systems. These are mainly three approaches to areas of expertise. Development of optimization tools for designing analog integrated circuits in CMOS technology in Cadence design environment. Activities are focused on design of the voltage comparator with very low-power consumption, design capacitor-less DC-DC converters, design of intelligent sensor chip for wireless sensor data transfer and linearization, design of MEMS structures for autonomous power supply for microsystems and further optimized design of analog integrated circuits. The development of intelligent sensor systems includes design issues of sensors and systems, the use of physical principles and materials, evaluation and processing of sensor signals.

ELECTRON DEVICE GROUP

THE EFFECT OF DIFFERENT STRAIN REDUCING LAYERS ON PHOTO- AND ELECTROLUMINESCENCE FROM InAs/GaAs QUANTUM DOT STRUCTURES

P. Hazdra, V. Komarnitskyy , J. Oswald*, K. Kuldová*, A. Hospodková*, E. Hulicius* and J. Pangrác*

*Institute of Physics of the AS CR, v. v. i.

Project support: the grant No. 202/09/0676 of the Grant Agency of the Czech Republic, Research Programme MSM 6840770014 - Ministry of Education, Youth and Sports of the Czech Republic

The effect of different InGaAs and GaAsSb strain reducing layers on photoluminescence and electroluminescence from self-assembled InAs/GaAs quantum dots grown by metal-organic vapour phase epitaxy was investigated. The aim was to shift their luminescence maximum towards optical communication wavelengths at 1.3 or 1.55 μm. Results show that covering by InGaAs strain reducing layer provides stronger shift of photoluminescence maximum (up to 1.55 μm) as compared to GaAsSb one with similar strain in the structure. This is caused by the increase of quantum dot size during InGaAs capping and reduction of quantum confinement of the electron wave function which spreads into the cap. Unfortunately, the weaker electron confinement in quantum dots is a reason of a considerable blue shift of electroluminescence from these InGaAs structures since optical transitions move to InGaAs quantum well. Although strong electroluminescence at 1300 nm was achieved from quantum dots covered by both types of strain reducing layers, the GaAsSb strain reducing layer is more suitable for long wavelength electroluminescence due to higher electron confinement potential allowing suppression of thermal carrier escape from quantum dots.

INTERACTION OF HYDROGEN AND DEUTERIUM WITH RADIATION DEFECTS INTRODUCED IN SILICON BY HIGH-ENERGY HELIUM IRRADIATION

V. Komarnitskyy and P. Hazdra

Project support: Research Centre LC06041, the grant No. 102/08/P488 of the Grant Agency of the Czech Republic and Research Programme MSM 6840770014 - Ministry of Education, Youth and Sports of the Czech Republic

Interaction of hydrogen and deuterium with radiation defects introduced by irradiation with high-energy alphas was investigated in the low-doped float zone and Czochralski silicon forming the base of p^+nn^+ diodes. To create localized defect layer, diodes were first irradiated with 2.4 MeV alphas to a fluence of $1x10^{10}$ cm^{-2}. Then, hydrogen or deuterium was introduced by rf plasma treatment at 250°C and diodes were isochronally annealed at temperatures

ranging from 100 to 400ºC. Reactions of hydrogen and deuterium with radiation defects were monitored by deep-level transient spectroscopy.
Results show that hydrogen rf plasma effectively neutralizes majority of vacancy related defects created by alpha-particle irradiation in both materials. In contrast with it, neutralization by deuterium plasma is substantially weaker. Disappearing of vacancy-related defect levels due to hydrogen (deuterium) is accompanied by introduction of two dominant deep levels at E_C-0.309 eV and E_C-0.365 eV. While hydrogenation significantly accelerates annealing of radiation defects, deuteration has weaker effect and gives rise to new defect levels during annealing.

COMBINED LIFETIME KILLING BY PLATINUM AND FAST LIGHT IONS IN SILICON POWER DIODE: THERMAL STABILITY OF INTRODUCED RADIATION DEFECTS

P. Hazdra and V. Komarnitskyy

Project support: Research Centre LC06041, the grant No. 102/08/P488 of the Grant Agency of the Czech Republic and Research Programme MSM 6840770014 - Ministry of Education, Youth and Sports of the Czech Republic

The influence of combined lifetime killing by platinum in-diffusion and fast light ion irradiation on generation and stability of introduced radiation defects was investigated in the low-doped n-type float-zone oxygen rich silicon forming the base of power p^+nn^+ diodes. Different concentrations of platinum substitutionals were introduced by platinum implantation and subsequent annealing at temperatures ranging from 725 to 900°C. Diodes were then irradiated with 1.8 MeV protons or 5 MeV alphas to fluences ranging from $5x10^9$ to $1x10^{12}$ cm^{-2}. The influence of platinum doping on introduction rates of dominant radiation defects and their thermal stability during subsequent isochronal annealing was investigated by deep-level transient spectroscopy. Results show that the presence of platinum atoms significantly influences introduction rates of dominant recombination centers introduced both by hydrogen and helium irradiation (vacancy-oxygen pairs, divacancies and VOH complexes). Simultaneously, temperature stability of vacancy-oxygen pairs and divacancies decreases of up to 150°C. In both cases, these effects are proportional to platinum concentration introduced into diodes.

LOW-TEMPERATURE FORMATION OF DEEP DONOR LAYERS BY PROTON IMPLANTATION: EFFECT OF HYDROGEN PLASMA ON RADIATION DEFECT REMOVAL

V. Komarnitskyy, P. Hazdra and V. Buršíková

Project support: Research Centre LC06041, the grant No. 102/08/P488 of the Grant Agency of the Czech Republic and Research Programme MSM 6840770014 - Ministry of Education, Youth and Sports of the Czech Republic

Deep donor layers were investigated in silicon p^+nn^+ diodes after implantation with 700 keV protons, subsequent treatment in rf hydrogen plasma and isochronal annealing up to 500ºC on air. Two types of diodes fabricated from oxygen-lean float-zone and oxygen-rich Czochralski silicon substrates were used. Effect of hydrogen plasma on radiation defect evolution was monitored by deep level transient spectroscopy and deep donor layers were characterized by C-V profiling. Results demonstrate that hydrogen plasma efficiently removes majority of vacancy-related defects resulted from proton implantation in both silicon substrates. Both the plasma treatment and post-implantation annealing lead to appearing of new defects in silicon band gap. In contrast with reference samples without plasma treatment, the treated samples with equivalent proton fluence demonstrate higher concentration of the residual damages, which increase with annealing temperature and, hence, lead to reduction of minority carrier lifetime. Simultaneously, hydrogen plasma deteriorates electrical properties of thermal hydrogen-related shallow donors. Concentration of hydrogen-related donors decreased after plasma-treatment compared to as-implanted samples. Development and shift of donor distributions detected by C-V measurement during subsequent annealing was attributed to shift of p-n junction depth. It was demonstrated that hydrogenated samples suffered from enhanced leakage current that remains high even after annealing at 400ºC.

P-i-N Diode with Low-Temperature Diffusion of Platinum, Palladium and Molybdenum

J. Vobecký, V. Záhlava, V. Komarnitskyy

Project Support: Research Centre LC06041, Research Program MSM 6840770017, Ministry of Education, Youth and Sports of the Czech Republic

Radiation enhanced diffusion of palladium by the radiation defects from He irradiation has provided the new concept of fast recovery diode with a buried p-layer called RED diode. In 2009, this concept has been proved to work at 4 inch wafer. The RED performed under the optimal temperature has been shown to compensate N-base doping uniformly at 100 mm wafer so that a resulting low doped P-layer is tightly fit to anode doping profile. As a result a standard high-power diode can be changed into the RED diode, in which a sufficiently low doping concentration of the additional P^- layer increases breakdown voltage and at the same time decreases dynamic avalanche during fast recovery. The

presence of Pd-related defects decreases carrier lifetime and provides soft recovery [1]. The analogous technology using the RED of platinum and molybdenum was studied in more details [2]. It has been shown that contrary to palladium, the platinum does not compensate the doping profile and there is negligible improvement of device parameters. With molybdenum, the situation is even worse, because contrary to platinum and palladium, it requires very high vacuum to diffuse into bulk.

SYNTHESIS OF NOVEL DEFECTS IN SILICON BY ION IRRADIATION FOR FUTURE APPLICATION IN SEMICONDUCTOR TECHNOLOGY

Project Manager: V. Komarnickij
Postdoctoral project of Czech Science Foundation (2008-10),
Project No. GP102/08/P488

Project will bring detailed information about influence of intrinsic defects (atoms of O, C, N) on generation and thermal stability of defects resulting from irradiation of silicon by protons and alphas. The project extends the topic studied within the framework of The Center of basic research LC 06041 and it will use its background and infrastructure. The atoms of O, C, N will be introduced in FZ silicon by ion irradiation. Their subsequent interaction with radiation defects will be studied by electrical methods (DLTS, HVCTS, C-V, I-V) in wide temperature range (100-700 C). Simultaneously, the effect of hydrogen (introduced either by proton irradiation or hydrogenation) on defect stability and electrical activity will be studied. The emphasis will be put on identification of new defects and mechanism of their generation. Their influence on silicon parameters (generation/recombination, doping) will be established to enable their use in development of radiation-hard and fast power devices.

STRUCTURES FOR SPINTRONICS AND QUANTUM PHENOMENA CREATED BY ELECTRON BEAM LITHOGRAPHY

Project Manager: J. Vobecký
Project No. KAN400100652

The aim of the project is: a) to study the tunnel anisotropic magnetorezistance (TAMR) of nanoconstrictions formed in thin layers of diluted magnetic semiconductors of the type (GaMn)As, considering the possible application in spintorics; b) the research of nano-diamond structures grown by the CVD method on lithografically patterned substrates; c) the growth of homogeneous fields of quantum dots on lithografically patterned substrates and their investigation by GISAXS and GID methods. The investigated structures will be created by a newly installed electron beam lithography.

OPTOELECTRONICS GROUP

NEW POLYMER OPTICAL COMPONENTS FOR PHOTONICS APPLICATIONS

Project Manager: V.Prajzler
Grant no. GACR 102/09/P104, Grant Agency of the Czech Republic

Goal of this project is to fabricate photonics structures as optical Y-branches and microresonators using easy fabrication process and low cost materials. Photonics structures will be designed by using RSoft software. I chose new type polymer Su-8 for my research due to its unique optical and mechanical properties (Low optical losses 0.08 - 1.5 dB/cm at wavelength 632.8 do 1550 nm, suitable refractive indices).

RESEARCH GRANTS AND CONTRACTS

Impact of Capping Layers on Electronic States in Quantum Dots
Grant no. GACR 202/09/0676, Grant Agency of the Czech Republic
Project Manager: **P. Hazdra**

Characterization of power diodes
ABB Switzerland Ltd, Semiconductors
Project Manager: **P. Hazdra**

Current Injection Capability Investigation of Microcontroller Units
Freescale Semiconductors Malaysia
Project Manager: **P. Hazdra**

Research Program MSM 6840770017 - Development, Reliability and Safety of Eletric Power Systems
Project Manager: Jan Vobecký (on behalf of Microelectronics Dept.)

One of the basic presumptions of sustainable development of human civilization is its provision of electrical energy that is reliable and respects all economic and ecological aspects. An electrical power system comprises an extensiveset of devices for the generation, transition distribution and usage of electrical energy.Both the single devices and the entire system must comply with high demands on quality of control, operational safety and reliability and the elimination of possible negative side effects.

Research Centre of Basic Research LC06041 "Preparation, Modification and Characterization of Materials by High-Energy Radiation "
Project Manager: Jan Vobecký (on behalf of FEE-CTU in Prague)

The project concentrates technical and personal capacities of participants with the aim to achieve higher quality and effectivity of experimental an theoretical research in the following main fields: - effects of energetic radiation on structure and properties of materials and their potential usage for preparation of new materials with outstanding electrical, optical and biological properties - development of techniques for preparation of nano- and micro- structured materials with potential applications in electronics, optoelectronics and medicine -development of new techniques for complex characterization of materials, especially those which are still unavailable in CR, including development of detectors with high spatial and energetic resolution.

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