PN II, Capacities Programme: *Project nr. 83/C_p/13.09.2007*

Project title: „*Laboratory for study of polymers photochemistry with excimer lasers*" (acronym: LASERLAB)

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The main objective of the project nr. 83/C_p/13.09.2007, entitled „*Laboratory for study of polymers photochemistry with excimer lasers*" (acronym: LASERLAB) from PN II Programme, consists in modernization and support of the research infrastructure from ICMPP at the standard of the most performance ones existing in Europe in all fields of science and technology. As follows, the researchers from ICMPP will have create the necessary support to enhance the base of knowledge and technological know-how from fundamental and applied physics, remaining at the forefront of the advancement of research and the conditions for establish contacts with other Institutions or industrial partners will be assured. Within the project framework, the concepts for infrastructure network modernization to be directed to study polymer photochemistry by using lasers and the modality through which such created infrastructure will provide the support to the preparatory phase for building the new research infrastructure are defined therefore.

The present project aims at supplying one laboratory from ICMPP with excimer laser equipments important for polymer photochemistry study. The initial part of any photochemical reaction involves a transition to some excited state of molecule through involving electronic, vibrational, and rotational excitation. The particular photochemical product that results from the absorption of light depends on the specific excited state species created during the irradiation, as well as the light source.

In agreement with I/2007 phase objectives and activities, "LASERLAB" laboratory was arranged/modernized according to European standards and in accordance with the optimal demands of the research-development equipments, and therefore, 2 excimer lasers of high performance, LPXPro and COMPexPro were acquired, mounted and working from the Coherent firm (http://www.coherent.com/) (through the Apel Laser SRL firm http://www.apellaser.ro/).

Technical and functional characteristics of excimer lasers

The acquired equipments possess the following characteristics:

LPXPro excimer laser works with XeCl gases mixture (laser, optical system, software)

- Works at 308 nm wavelength
- Reproducible precision in materials processing (polymers)
- Allows the study of photochemical processes (e.g., photoisomerization, photocleaving, ablation, grafting) avoiding material photodecomposition; other applications: marking (high-speed cable, eyeglass and Teflon marking), material processing (inkjet nozzle drilling, diamond and sapphire drilling, FBG writing, transparent conductive oxides structuring), surface treatment (pulsed laser deposition, laser direct synthesis, laser direct patterning, ion implantation/doping/implant activation, cleaning, gas-assisted laser etching), measurements (optics testing, spectroscopy, laser induced fluorescence)
- Allows modification of polymer surfaces
- Has an energetic stability of laser beam of min. 1%
- Allows an homogeneous profile of laser beam
- The lasting of laser pulse is between 10-30 nsec, an energy/pulse of max. 300 mJ, a pulsed repetition rate until 200 Hz, an average power of max. 45 W.

Technical characteristics of the optical system

- The optical system has the following specifications: operates at 308 nm wavelengths, displays an optical table extremely stable, possess a temperature stabilization module for project lens, possess an energy density at the substrate level of min. 1000 mJ/cm^2,

has an optical resolution of at least 10 μm and a performance control system, it is possible the to look at the process by using a video camera, has an illumination homogeneity of at least 5% for long axis, has an attenuator of motorized beam, possess a table for translation-rotation for x,y,z axes.

COMPexPRO excimer laser works with two different gases mixture ArF, KrF (laser, optical system, software):

- Operates at 193 nm (ArF) and 248 nm (KrF) wavelengths
- Reproducible precision in materials processing (polymers)
- Allows the study of photochemical processes (e.g., photoisomerization, photocleaving, ablation, grafting, direct photoionization, microlithography; other applications: marking (Teflon marking), material processing (diamond and sapphire drilling, FBG writing), surface treatment (pulsed laser deposition, laser direct synthesis, laser direct patterning, ion implantation/doping/implant activation, cleaning, gas-assisted laser etching), measurements (optics testing, spectroscopy), medical procedures (psoriazis/vitiligo treatment, refractive eye surgery)
- Allows modification of polymer surfaces
- Has an energetic stability of laser beam of min. 1%
- Allows an homogeneous profile of laser beam
- The lasting of laser pulse is between 10-30 nsec, an energy/pulse of max. 700 mJ, a pulsed repetition rate until between 30-50 Hz, an average power of max. 25 W.

Technical characteristics of the optical system

- The optical system has the following specifications: operates at two different wavelengths (193 and 248 nm), displays an optical table extremely stable, possess an temperature stabilization module for project lens, possess an energy density at the substrate level of min. 1000 mJ/cm^2, has an optical resolution of at least 10 μm and a performance control system, it is possible the to look at the process by using a video camera, has an illumination homogeneity of at least 5% for long axis, has an attenuator of motorized beam, possess a table for translation-rotation for x,y,z axes.

In the following step the acquisitions of disposable elements, accessories, as well as the technical support for configuration, installation and hardware/software up-grade will be pursued. As concerning the personnel training for specialists in the laser field, an initial training has been already performed at ICMPP, following an additional one at the producer

headquarter (Coherent firm).

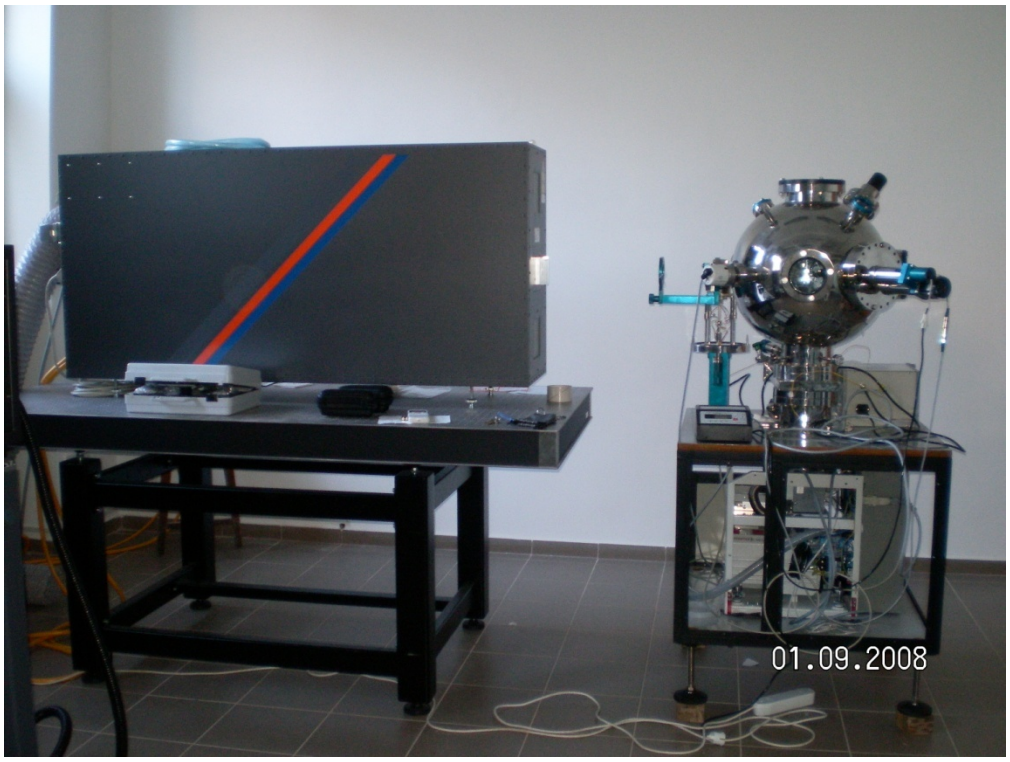
The laser excimers will be used for study of polymer photochemistry (photoisomerization, photocleaving, ablation, grafting, direct photoionization), laser ablation, microlithography, surface modification (pulsed laser deposition, laser direct synthesis, laser direct patterning, ion implantation/doping/implant activation, cleaning, gas-assisted laser etching), measurements (optical tests, spectroscopy, laser induced fluorescence) or material processing (high-speed cable, transparent conductive oxides structuring). At the same time, through acquisition of an spectrometer with optical fibre and an ICCD camera ((intensified charge-coupled device), an quantitative analysis at the substrate surface, spectral analysis, fluorescence measurements, identification of life-times for excited species, biomolecules visualization will be possible.

The equipments will start to work in November this year, and the rules concerning the access, creation of a database, as well as the organization of meetings on laser topics in the field of polymer chemistry will be established.

Concrete, by these facilities offered by the new research infrastructure will benefit particularly the traditional partners of ICMPP – at local level, „Gh. Asachi" Technical University, „Al. I. Cuza" University, „Ion Ionescu de la Brad" University of Agricultural Science and Veterinary Medicine, „Gr. T. Popa" University of Medicine and Pharmacy, Institute of Technical Physics; at national level, Bucharest University, Bucharest Polytechnic University, Babes-Bolyai University Cluj Napoca, Chemical-Physical Institute and Organic Chemistry Institute (Romanian Academy, Bucharest), ICECHIM Bucharest, Institute of Chemistry Timisoara (Romanian Academy), „Raluca Ripan" Institute - Cluj-Napoca, Transilvania University – Brasov. Other partners from economic media can be added to this list – especially in the NE part of the country – and the ICMPP partners from abroad (the Institute is involved in more multi-partner project financed by European programmmes, PC6 mainly). The forming aspect of the present project cannot be ignored – young people that wish to adopt the scientific career and that learn in the Universities from Iasi will be able to be training in the frame of the proposed laboratory.

Images of excimer lasers


01.09.2008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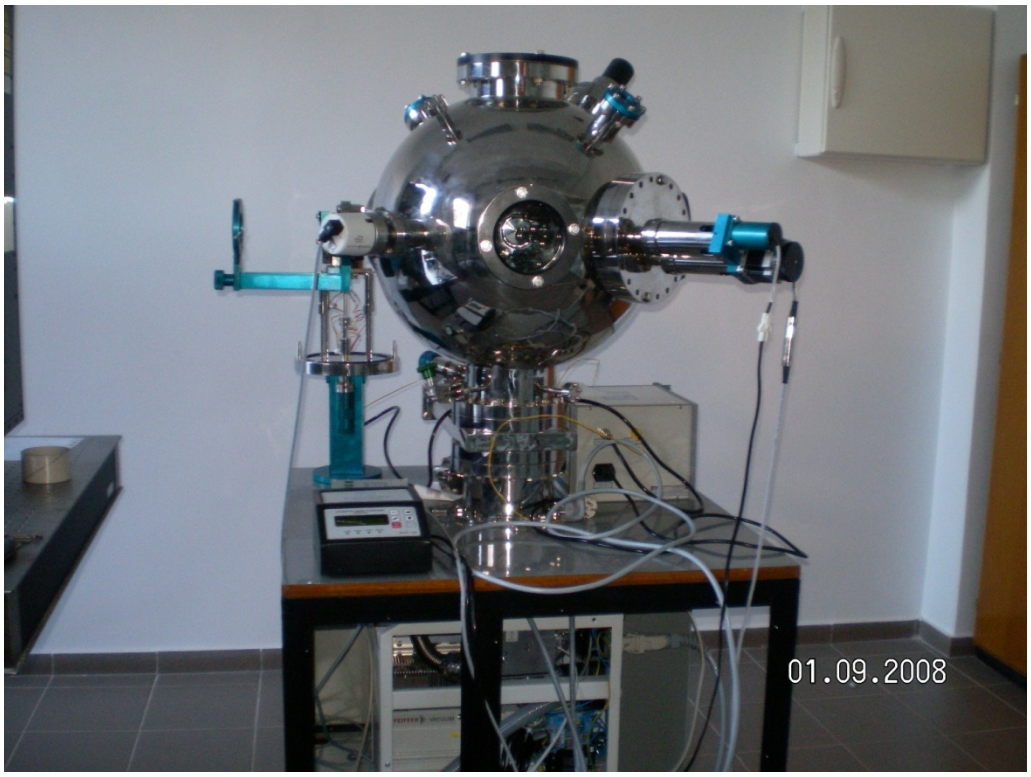
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COHERENT
COMPex Pro
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Images of personnel


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