

E 3: ANTIFUOLING - ELASTOMERS - RESINS

R&D areas of Team 7 belong to the Polymer Science:

- radicalic polymerization in heterogeneous phases, polymers modification by chemical reactions, synthesis of polymer-silicate composites and nanocomposites, synthesis and characterization of various macromolecular compounds and hybrid materials;
- synthesis and characterization of bio-degradable polymeric composites based on renewable resources;
- anionic synthesis and characterization of styrene-diene block-copolymers, their modification by analogous reaction and using in recycling of polyolefin materials;
- synthesis of liquid, semisolid and solid Epoxy Resins and modification various diluents and/or mineral fillers;
- synthesis and characterization of hydridin elastomers based on binary and ternary copolymers of oxiranes;
- modifications of polymers by cross metathesis and ROMP in the presence of Grubbs catalyst;
- synthesis of antifouling composite materials which (coating) must have double roll anticorrosive and antifouling protection.

Projects and achievements

- **Project Inovare 209 /2008-2011** “Innovative materials for UV photopolymerizable coating materials“(MATUV) has realized two technologies for synthesis of di- and tri- block styrene-butadiene copolymers. Using these polymers was obtained one technology for protective coating of metals in the chemical milling process. The project results: 1 published paper, 1 participation at PRIOCHEM and 1 patent application (OSIM no. A/ 00945/18.11.2009).

- **Project PNCDI II no. 32 -169 /2008-2011** “Intelligent polymer composites with antifouling properties for maritime ships insulation and antifouling protection. Identification antifouling materials influences against sea environment“ (ECOMPUR) has realized two technologies composite modified polyurethane based with antifouling properties based on organozinc and organocopper, 7 specific trying methods (standards). The project results: 2 patents application (OSIM no A/00497/24.05.2011, and A/00972/29.09.2011), 3 participations at PRIOCHEM, and 2 participations at International Conferences.

- **Project CEEEX 177/2006-2008** “High-performance materials based on chemically modified and/or nanostructured polymers for industry and medical applications“ (MATPOLMOD) was obtained one technology for synthesis a new styrene-butadiene block-copolymer with controlled polybutadiene microstructure. The project results: 1 published paper, 1 participation at PRIOCHEM, 1 participation at Macro Iasi.

- **Project PNCDI II no 72-193/ 2008-2011** “Innovative technology and plant for making selective biocompatible membranes with the human blood destined to an extrabodily oxygenating device“ (MEMBIOX) has realized one technology for making selective membranes biocompatible with the human blood destined to an extracorporeal oxygenating device.

- **Project CEEEX No. contract S 13 /2005-2008** ”Polymer-layered inorganic nanocomposites as hybrid reinforced at nanometrical scale” has obtained one technology for the synthesis of a reinforced new inorganic nanocomposites by layer structure. The project results: 3 published papers, and 2 participations at International Conferences.

- **Project PNCDI II No. 71-125 (1519)/2007-2010** “Advanced materials for aerospace and transportation: nanocomposite polymer / reinforced carbon with carbon fiber and silicon carbide structures”. The project obtained the epoxy nanocomposites based on nanocarbon and nano silicon carbide reinforced with carbon fiber/glass for obtaining advanced materials for aerospace and transportation. The project results: 2 article and participated in 6 conferences at International Conferences.

- **Project PNCDI II No. 71-092 /2007-2010** “Mezomorfe chromogen-polymer systems organized supramoleculare architectures for smart surfaces with controllable properties”. The project obtained polymeric mezomorfe systems with liquid crystal characteristics. The project results: 2 published articles and 1 participation at national conferences.

- **Project PNCDI-PN II No. 31-049/2007-2010** “Construction elements of nanocomposites based on phase change materials (PCM)-epoxy for waste storage and solar energy used in buildings with low energy consumption". The project obtained the epoxy materials for solar energy and waste storage building with low energy consumption. The project outcomes: 1 article and 4 participations at International Conferences, 1 patent application (OSIM no. A/ 00242/ 17.03.2009).

- **Direct contract No.1714/2008** - „Rehabilitation of pipelines to transport natural gas under pressure”, Beneficiary: S.C. PROFGAS S.R.L.

- **Direct contract No.74 / 2007** - “Studies to identify trouble-shooting technology type lack of material on the pipes under pressure, using complex shells”, Beneficiary: Oil – Gas University Ploiesti.

- **Project CEEEX Contract No. 234/2006-2010** "Methodologies for the development and characterization of polymer nanocomposite dielectric properties of insulating".

- **Project CEEEX Contract No. 445/ 2005-2008** "Advanced multifunctional materials doped with silver nanopowders”.

Evolution in time:

- The technological research intensification for obtaining new materials either by synthesis, especially by modification of existent polymers either by post-polymerization reactions or by nanocomposites obtaining. Thus there were obtained advanced materials for aerospace and transport based on carbon nanocomposites and storage residual materials using solar energy for low energy buildings.
- There was obtained a progress in application in technologies development of fundamental knowledge in inorganic chemistry, supramolecular chemistry (host-guest chemistry), radiochemistry.
- There was obtained intelligent polymer composites with antifouling properties for maritimes ships insulation and antifouling protection and was determined the influences of antifouling materials against sea environment.

Interdisciplinary initiatives:

- for the development of new polymeric materials were used interdisciplinary knowledge of organic and inorganic chemistry, physics, physical chemistry of polymers, supramolecular chemistry, radiochemistry, statistical mathematics, process engineering.
- nanocomposites synthesis: combining information from polymer chemistry and inorganic chemistry.
- fire extinguishing powders synthesis: combining information from inorganic chemistry and organic chemistry.
- calixarene applications: assembling a team with interdisciplinary knowledge: supramolecular chemistry and radiochemistry.
- for the development of the starch-based materials were used interdisciplinary knowledge of chemistry, physics, physical chemistry of polymers, statistical mathematics, process engineering.
- in synthesis and characterization of new styrene-diene block-copolymers were used interdisciplinary knowledge of macromolecular chemistry, mechanical, rheological and physical chemistry of polymers.
- epoxy nanocomposite with different nano fillers: nanocarbon, silicon carbide, molybdenum sulphide for obtaining advanced materials for aircraft, construction transport;
- epoxy materials for solar energy and waste storage building with low energy consumption;
- modified epoxy resins by synthesis for application concerning the reduction and control of structural vibrations (construction materials; automotive, aviation).

The team has well relationships in many complex projects with Physical Chemistry Institute "Ilie Murgulescu", Chemistry Faculty from the “Politehnica” University Bucharest, INCDFLMR, Elie

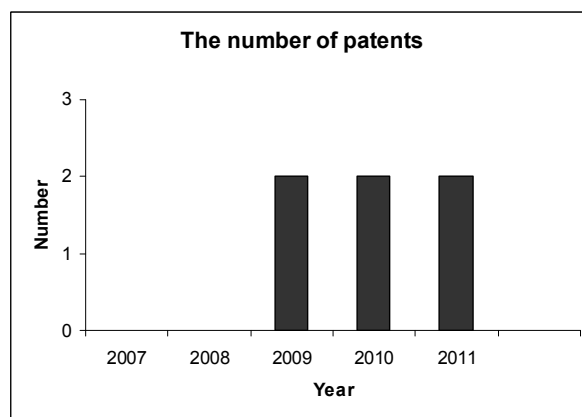
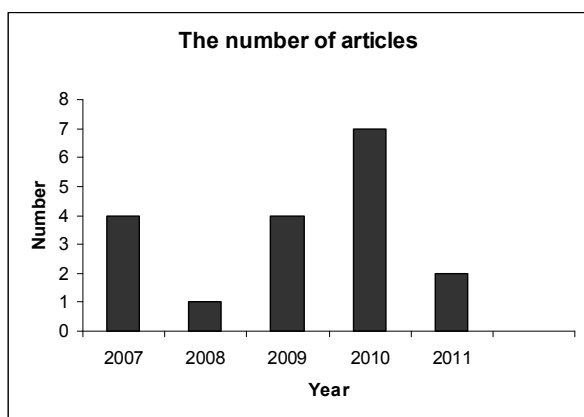
Carafoli Aerospace Research Institute, Organic Chemistry Center “C.D.Nenitescu” of Romanian Academy, Research Center for Macromolecular Materials and Membranes.

Visibility activities (from 2007):

For the dissemination of results were published 18 articles and numerous communications were performed at national and international symposiums and conferences.

For protection of research results were registered **6 patent applications**.

The evolution in time of the published articles and patent applications are presented in the next figures:



Human resources evolution:

In 2008 -2011 period were obtained a PhD title, two PhD stages are also in progress.

Two CS III degree research were obtained, and many knowledge refreshing courses were absolved.

In 2008 was employed a new chemical engineer absolvent of “Politehnica” University –Bucharest.

Other significant aspects

One member of our research team was reviewer/member in the Editorial Board of the ISI quoted journal “Mat Plast”.

An important attention was given to the **continuing vocational training** of our team’s members in the specific scientific areas and in other fields, such as the European funding rules, by participation to various courses and seminars.