

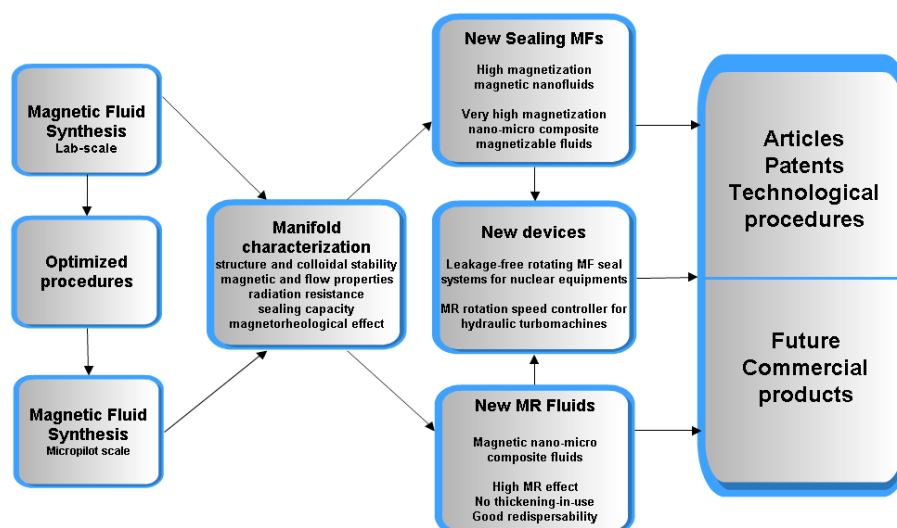
HIGH MAGNETIZATION MAGNETIC NANOFUIDS AND NANO-MICRO COMPOSITE MAGNETIZABLE FLUIDS: APPLICATIONS IN HEAVY DUTY ROTATING SEALS AND MAGNETORHEOLOGICAL DEVICES

Goal of the project

The project is oriented to the extension of performances of rotating seals and adaptive motion control devices to meet the requirements of several well-defined new applications, by high and very high magnetization sealing fluids and new type of magnetorheological fluids to be synthesized.

Short description of the project

The project concept and objectives are illustrated schematically in figure below.



The workflow is organized along the following main directions: lab-scale and micro-pilot scale synthesis of high magnetization and radiation resistant magnetic nanofluids and nano-micro composite fluids for heavy duty (high pressure and /or rotation speed, contaminated medium) rotating seal and semi-active magnetorheological motion control applications; advanced structural, magnetic, rheological, magnetorheological characterization of the new magnetizable fluids; accelerated (irradiation) ageing and sealing capacity tests; design, manufacturing and experimental testing of leakage-free rotating seals for nuclear equipments and magnetorheological rotation speed controller devices for hydraulic turbomachines. The new rotating seal and motion control systems for nuclear and hydraulic equipments offer better quality than usual solutions have, will help to gain new market shares and open technological advantages over traditional manufacturing routes. The seal systems proposed for nuclear equipments offer much higher level of environmental protection over traditional sealing units due to the leakage-free property of magnetic fluid rotating seals, increasing the commercial value of the solutions proposed.

Project implemented by

- Romanian Academy – Timisoara Branch (Project coordinator),
- Politehnica University of Timisoara (Partner 1),
- S.C. ROSEAL S.A. Odorheiu Secuiesc (Partner 2)
- National Institute for R&D in Electrical Engineering ICPE-CA Bucuresti (Partner 3).

Implementation period

July 23, 2012 – December 31, 2016

Main activities

Main activities of the MagNanoMicroSeal project are: (O1) Synthesis and manifold characterization of magnetizable fluids for high pressure and heavy duty rotating seals and magnetorheological devices and, respectively, (O2) Design, fabrication and testing of leakage-free magnetofluidic rotating seal and magnetorheological(MR) control devices for well-defined applications/exploitation conditions.

Results

The main results of this project, to which Politehnica University of Timisoara contributed, refer to the elaboration of the following technological procedures:

- synthesis of high magnetization sealing fluids;
- synthesis of nano-micro structured magnetorheological fluids and qualification procedures;
- magnetic nanofluids for rotating seals for nuclear equipments.

The contributions of Politehnica University of Timisoara refer mainly to complex magnetic, rheological and magneto-rheological analyses of the magnetic sealing fluids and nano-micro structured magnetorheological fluids. The Politehnica University team oversaw the characterization of the magnetic nanofluids to be used for seals.

The results obtained in 2016 by the UPT team were disseminated in: Oana Marinica, Daniela Susan-Resiga, Florica Balanean, Daniel Vizman, Vlad Socoliuc, Ladislau Vekas, Nano-micro composite magnetic fluids: magnetic and magnetorheological evaluation for rotating seal and vibration damper applications, *Journal of Magnetism and Magnetic Materials*, 406, 134-143 (2016), FI=2.357 (2015/2016).

Applicability and transferability of the results

The technological progress is strongly evidenced by future commercial products planned for the industrial partner SC ROSEAL SA: 16 new type of magnetically controllable fluids, 1 prototype and 3 functional models of magnetofluidic devices for nuclear and hydraulic power engineering.

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Research centre

Research Centre for Engineering of Systems with Complex Fluids – Magnetometry Laboratory, Rheology Laboratory and Numerical Simulation and Parallel Computing Laboratory, from Politehnica University of Timisoara. URL: <http://mh.mec.upt.ro/ccisfc/>

Research team

The project research team consists of 42 researchers, engineers and technicians lead by

Dr. Ladislau VÉKÁS, the director of the MagNanoMicroSeal project (Romanian Academy Timisoara Branch).

The Politehnica University of Timisoara (Partner 1) research team in this project consist of 6 researchers and 2 research assistants, as follows:

Assoc. Prof. Dr.-Eng. Floriana D. STOIAN, project responsible for partner 1,
Phys. Oana Marinică,
Lect. Dr.-Eng. Mat. Sorin Holotescu,
Assoc. Prof. Dr.-Eng. Nicolae Crainic,
Lect. Dr.-Eng. Andreea Dobra,
Lect. Dr.-Eng. Adelina Han,
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