2014 - 2015

RESEARCH & DEVELOPMENT

S.C. ROSEAL® S.A.

CONTENT

RESEARCH STRATEGY OF THE ROSEAL CO.

ROSEAL Co. Odorheiu Secuiesc is a SME specialized in manufacturing sealing systems, aiming permanently to fulfill the market - driven requirements for new and innovative performance products. Since 1981, activities include research, design, production and marketing of mechanical and magnetofluidic seals, manufacturing specific spare parts of various materials and services.

Roseal Co. is developing and manufacturing carbographitic materials, superaluminous ceramics, elastomers and PTFE for spare parts. Over the years a large number of specific mechanical seals and components have been designed, built and tested, which currently solve concrete cases of chemical, petrochemical and nuclear power industry. ROSEAL Co. has integrated management systems (ISO 9001-2008 quality assurance, environmental managament ISO 14001-2005 and Occupational Health and Safety Management SR – ISO OHSAS 18001-2007) and is licensed for Nuclear Quality Management Systems, Class 1, ASME Code, Section III, Subsection NCA, art. 4000 and for ISCIR according to NPSM-2008.

In this context, ROSEAL Co. became a member and even a founding member of the Romanian Association for Promotion of Magnetic Fluids, Romanian Atomic Forum - ROMATOM, Association of researchers, designers, manufacturers and exporters of circulation pumps in Romania (APPR), etc.

Being highly receptive to new technologies, ROSEAL Co. has developed long-term S&T cooperation with national Research & Development institutes and high ranked universities from Romania.

The company team has gained research experience by participating and leading several national research projects (16 national projects).

Among the most important achievements obtained in collaboration with Romanian Academy – Timisoara Branch, Center for Fundamental and Advanced Technical Research, Laboratory of Magnetic Fluid is the synthesis of magnetic nanoparticles, nanofluids and nano-micro structured composite magnetizable fluids even at micropilot scale with excellent quality, used in various long-term (~ 5 years) sealing systems.

Advanced research have been performed for achieving polymeric and carbographitic heat-proof materials with increased life-time for seal gaskets exposed to radiation.

Research results were also disseminated through numerous scientific papers, posters, patents and innovations.

RESEARCH STRATEGY OF THE ROSEAL CO.

MAIN RESEARCH DIRECTIONS:

New materials
- Multifunctional materials and nanostructures: magnetic nanoparticles, magnetic nanofluids, nano-micro structured magnetizable fluids
- Carbon-graphite materials
- Ceramic materials

Experimental models and prototypes
- Design/Engineering workshop
- Testing laboratory for dynamic seals

Marketing and international cooperation development based on well defined research projects mainly in the field of nanomaterials and nanotechnology.

RESEARCH STRATEGY OF THE ROSEAL CO.

SUCCESSES IN NANOTECHNOLOGY RESEARCH

Preparation of surface coated magnetite nanoparticles and magnetic nanocomposites for biomedical applications

- Magnetite nanoparticles (mean size less than 10 nm) with biocompatible hydrophobic coating (e.g. oleic acid monolayer)
- Magnetite nanoparticles (mean size less than 10 nm) with biocompatible hydrophilic coating (e.g., oleic acid double layer)

Micro-pilot scale synthesis of high magnetization magnetic nanofluids and nano-micro structures magnetizable fluids

- Synthesis of magnetic nanofluids for biomedical applications
- Synthesis of high magnetization magnetic nanofluids for technical applications
- Synthesis of nano-micro structured magnetizable fluids for technical applications

Development of magnetic nanofluid seal systems

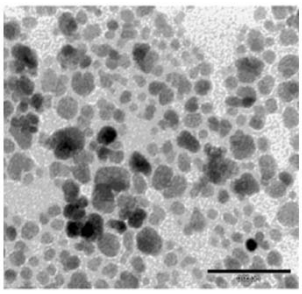
- Static or low speed magnetofluidic seals:
  - Magnetofluidic seal for high power electric switches
  - Magnetofluidic seals for vacuum deposition systems
- Mechanical – magnetic fluid tandem seal for liquefied gas pump
- Gas valves up to 40 bar equipped by a sealing system using high magnetization magnetic nanofluids or magnetic composite fluids

New insulated and cooling medium for power transformers

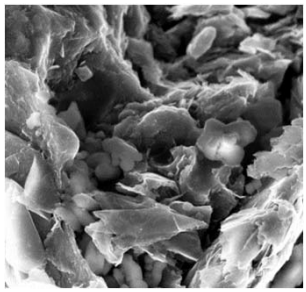
RESEARCH STRATEGY OF THE ROSEAL CO.

Research partners:

Romanian Academy – Timişoara Branch,
Center for Fundamental and
Advanced Technical Research
Bd. Mihai Viteazu, nr. 24, 300223 – Timişoara, Timiş



"Politehnica" University of Timişoara,
Research Center for Engineering of Systems
with Complex Fluids
Bd. Mihai Viteazu, nr. 1, 300222 – Timişoara, Timiş



National Institute for R&D in Electrical Engineering
ICPE-CA
Splaiul Unirii, nr. 313, 030138 – Sector 3, Bucharest

RESEARCH INSTITUTES

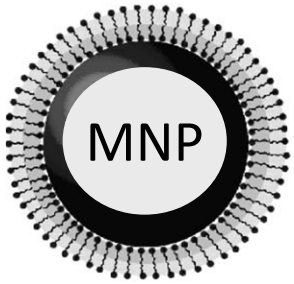
- ✓ NIRDIMT Cluj Napoca
- ✓ ICEM Bucharest
- ✓ ICECHIM Bucharest
- ✓ CCSITUATF Bucharest
- ✓ Uzina G Râmnicu Vâlcea
- ✓ INFLPR Măgurele
- ✓ ROSA

UNIVERSITIES

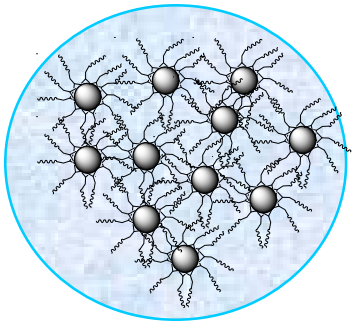
- ✓ University Politehnica of Bucharest
- ✓ Technical University of Cluj Napoca
- ✓ University of Bucharest

SURFACE COATED MAGNETITE NANOPARTICLES AND MAGNETIC NANOCOMPOSITES FOR BIOMEDICAL APPLICATIONS

1. Magnetite nanoparticles (mean size less than 10 nm) with biocompatible hydrophobic coating (e.g. oleic acid monolayer)
2. Magnetite nanoparticles (mean size less than 10 nm) with biocompatible hydrophilic coating (e.g. oleic acid double layer)
3. High magnetization magnetic nanoparticle clusters with controlled size and hydrophilic coating
4. Magnetite nanoparticle clusters encapsulated in biocompatible microgel polymer



organic polar carrier
double layer
sterical stabilization



SYNTHESIS PROCEDURES

Chemical co-precipitation+sterical stabilization
For organic non-polar carrier liquids - **monolayer** surfactant coated MNPs

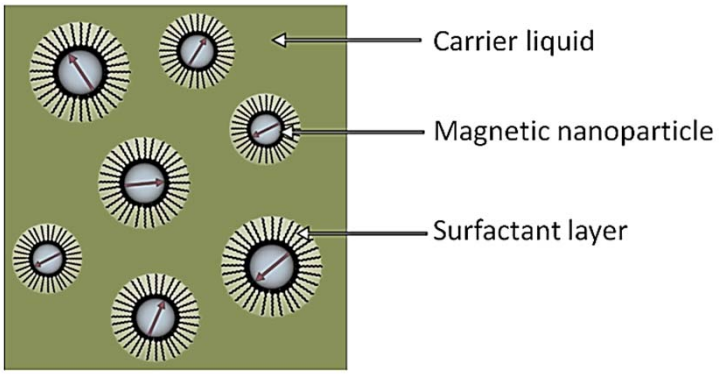
Chemical co-precipitation+sterical stabilization
For organic polar carrier liquids - **double layer** surfactant coated MNPs

- D. Bica, R.Minea, Patent RO 97556(1989); D. Bica, Rom. Rep. Phys. 47(1995);
- L. Vekas et al. Rom. Rep. Phys. 58(2006); M.V. Avdeev, D. Bica et al. JMMM, 311 (2007)
- D. Bica et al. Patents RO 93107 (1987), 93162 (1987), 97224 (1989),97599(1989), 105048 (1992), 115533 (2000);
- D. Bica, Rom. Rep. Phys. 47(1995)
- D. Bica, L. Vekas, M. Rasa, J.Magn.Magn.Mater. 252 (2002)

MAGNETIC NANOFLUID

General characteristics:

- Ultrastable colloidal suspensions of magnetic **nano**particles (**3-15 nm**) in a carrier liquid ➡ **no sedimentation**
- Quasihomogeneous magnetizable liquids
- Approximatively **Langevin** type magnetic behavior and **Newtonian** flow properties, small magnetoviscous effect

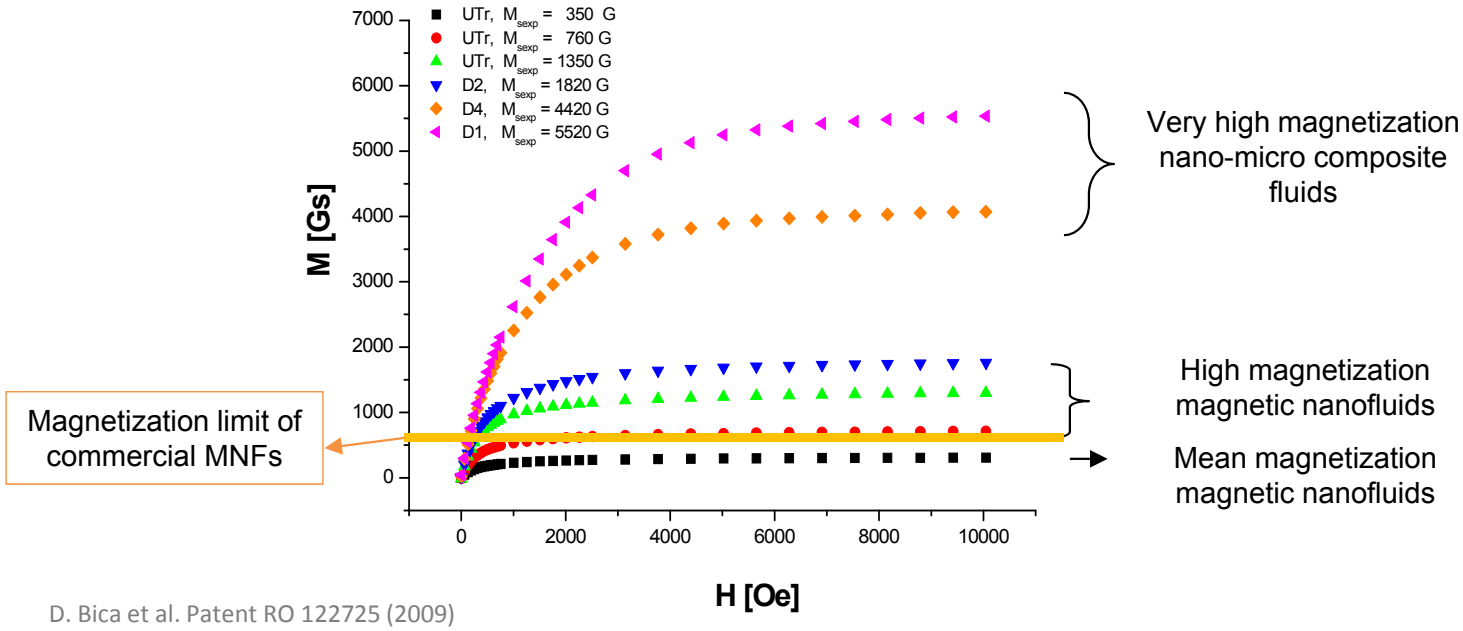


Sterical, electrostatical or mixt stabilization prevents:

- gravitational settling of magnetic nanoparticles;
- agglomerate formation by dipolar and van der Waals interactions.

Magnetic Fluid Laboratory, Timișoara - ROSEAL Co. Odorheiu Secuiesc

Saturation magnetization of MNFs and nano-micro composite fluids



D. Bica et al. Patent RO 122725 (2009)
D. Bica et al. Patent RO 115533 B1 (2000); OSIM Nr. deposit 2008-00326/05.05/2008

MAGNETIC NANOFLUID

Since 1981, Roseal Co. Odorheiu Secuiesc has started a fruitful collaboration with the Laboratory of Magnetic Fluids, Center for Fundamental and Advanced Technical Research, Romanian Academy - Timisoara Branch, led by, Dr. Phys. Ladislau Vékás, corresponding member of the Romanian Academy, which resulted the synthesis of several types of magnetic nanofluids and magnetic composite fluids, many of them even at micro-pilot scale and also the development of different types of magnetic fluid sealing systems.

Project NanoMagneFluidSeal

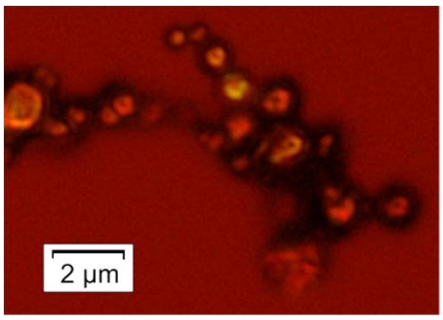
Micro-pilot unit
Technology transfer- ROSEAL Co.

Magnetic nanofluid and magnetizable composite fluid range prepared at the Roseal Co. for leakage-free rotating seals:

Magnetizable fluids	*Magnetic particles*	*Carrier liquid*	*Surfactant*	*Saturation magnetization*	*Viscosity*
NFM **- laboratory -**	Magnetite, Maghemite (D = 6÷8 nm)	Light hydrocarbons, mineral oils, oil synthetic	Carboxylic acid, DBS, PIBSA, PIBSI	50 ÷ 1450 G (tranfomer oil) 50÷ 800 G (high vacuum oil)	0.03 Pa·s ÷ 14 Pa·s (tranfomer oil) 0.3 Pa·s ÷ 20 Pa·s (high vacuum oil)
NFM **- micropilot -**	Magnetite, Maghemite (D = 6÷8 nm)	Light hydrocarbons, mineral oils, oil synthetic	Carboxylic acid, DBS, PIBSA, PIBSI	50 ÷ 900 G	0.03 Pa·s ÷ 0.3 Pa·s (transformer oil)
CMF **- laboratory -**	Magnetit (D = 6÷8 nm) + Fier (D = 1÷10 µm)	Light hydrocarbons, mineral oils, oil synthetic	Carboxylic acid, DBS, PIBSA, PIBSI	1500÷6000 G	5 Pa·s ÷ 5000 Pa·s (transformer oil)

NANO-MICRO STRUCTURED MANGETIZABLE FLUIDS

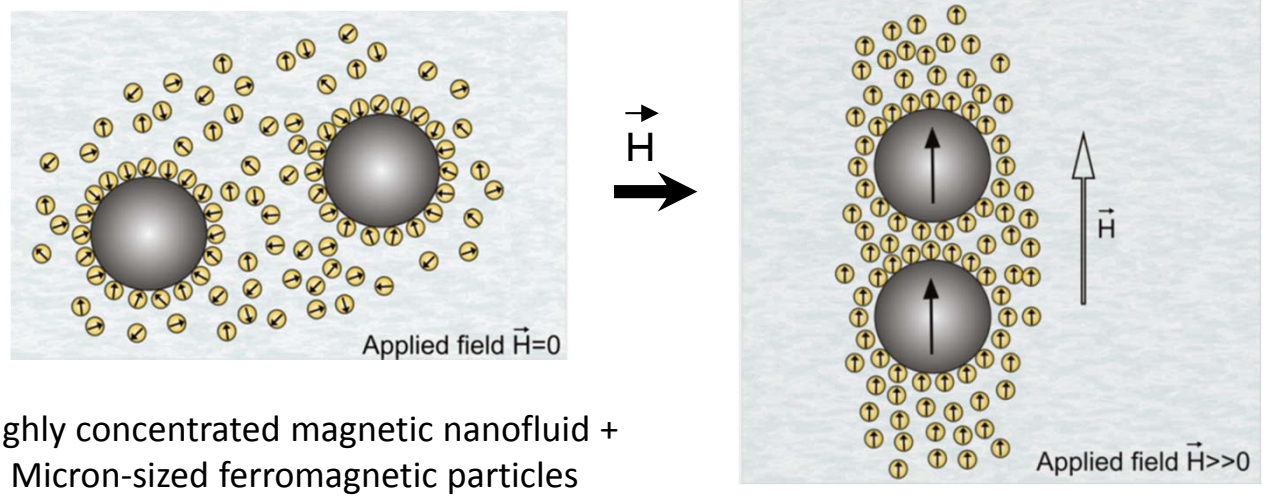
Nano-micro-structured composite magnetizable fluids (CMF) are suspensions of micron sized iron particles in magnetic nanofluids. These extremely bidisperse fluids acquire several benefits by combining the advantages of both MR fluids and MNFs: high magnetization, high magnetoviscous effect, increased stability against sedimentation and easy redispersibility. Due to the presence of the large micron sized iron particles these fluid have an extremely large saturation magnetization, which allows using them in high pressure applications with special performance, such as high pressure magnetofluidic seals. Moreover, the presence of magnetic nanoparticles improves the magnetorheological behavior of the CMFs in a significant way in comparison with a commercial MR fluid with similar magnetic solid content.



Optical microscope image of a thin film of high magnetization nano-micro composite fluid

HIGH MAGNETIZATION + HIGH MAGNETORHEOLOGICAL EFFECT + INCREASED SEDIMENTATION STABILITY

Magnetic nanoparticles and micron sized iron particles structuring :



Highly concentrated magnetic nanofluid + Micron-sized ferromagnetic particles

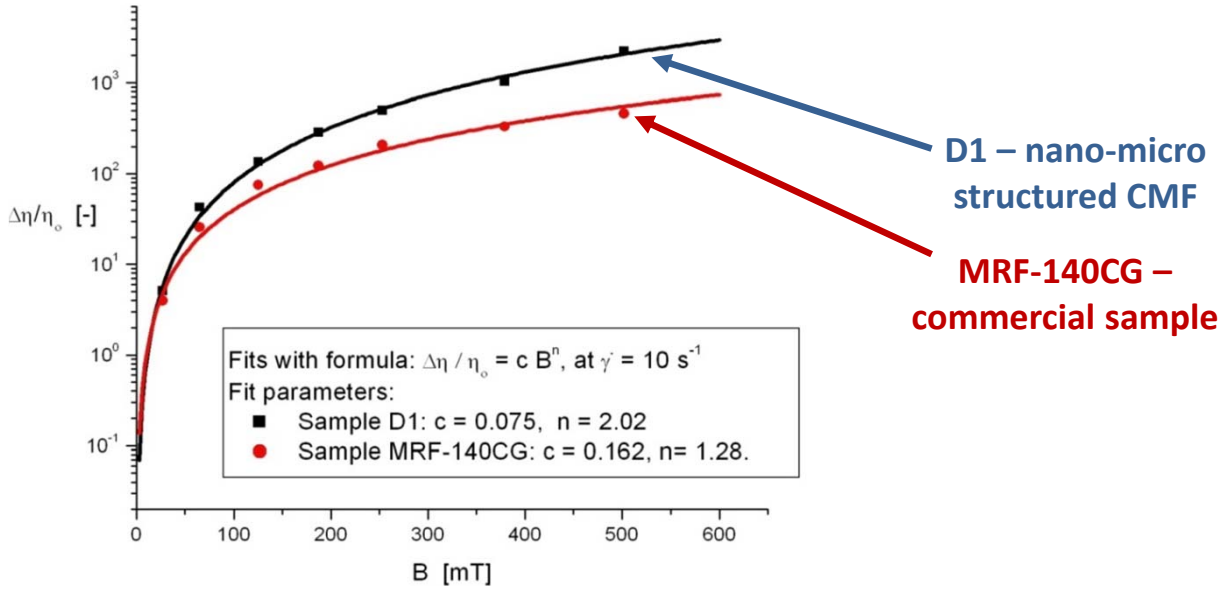
- D.Bica et al. Patent RO 122725(2009)

NANO-MICRO STRUCTURED MANGETIZABLE FLUIDS

HIGH MAGNETORHEOLOGICAL EFFECT

Composite magnetic fluid: D1 : $\phi_{micro} \approx 0.2$; $\phi_{nano} \approx 0.2$;

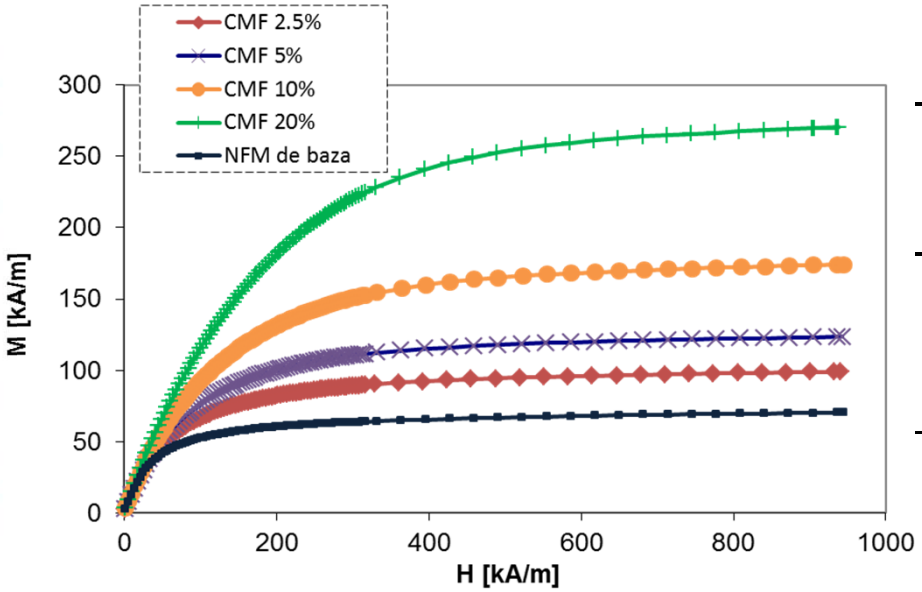
Magnetorheologic fluid MRF – 140 CG : $\phi_{micro} \approx 0.4$;



D. Bica et al. Patent RO 122725 (2009)
D. Resiga, D. Bica, L. Vékás, J.Magn.Magn.Mater., 322 (2010) 3166–3172

Adding micron-sized iron particles, the saturation magnetization (**Ms**) of magnetic fluids can be increased about **6 times**, obtaining fluids with extremely high magnetization (up to **6000 G** = 478 kA/m) especially compared to conventional magnetic fluids (up to **600 G** ~ 48 kA/m).

INCREASED MAGNETIZATION



Magnetization curve of the composite magnetic fluids and magnetic nanofluid carrier liquid.

Investigated CMFs:

Sample	V_{Fe}/V_{NFM}
CMF 2.5%	0.025
CMF 5%	0.05
CMF 10%	0.1
CMF 20%	0.2

Lake Shore 7407
TUD Germania

NANO-MICRO STRUCTURED MANGETIZABLE FLUIDS

Project MagNanoMicroSeal

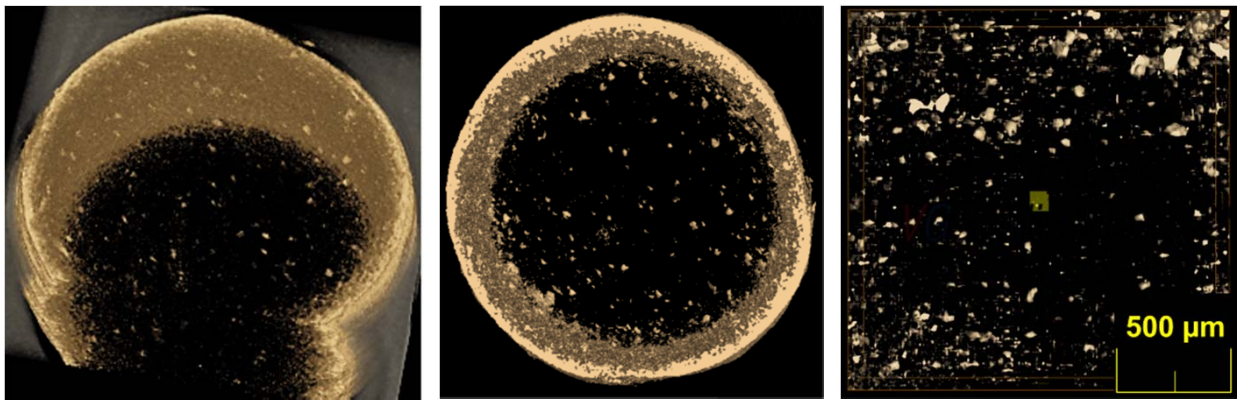
PNII PCCA Type 2
Contract No. 157/2012

X-ray microcomputed tomography (XµCT) investigation of nano-micro composite magnetizable fluids

- Magnetic field gradient influence on the iron particle structures suspended in magnetic nanofluid

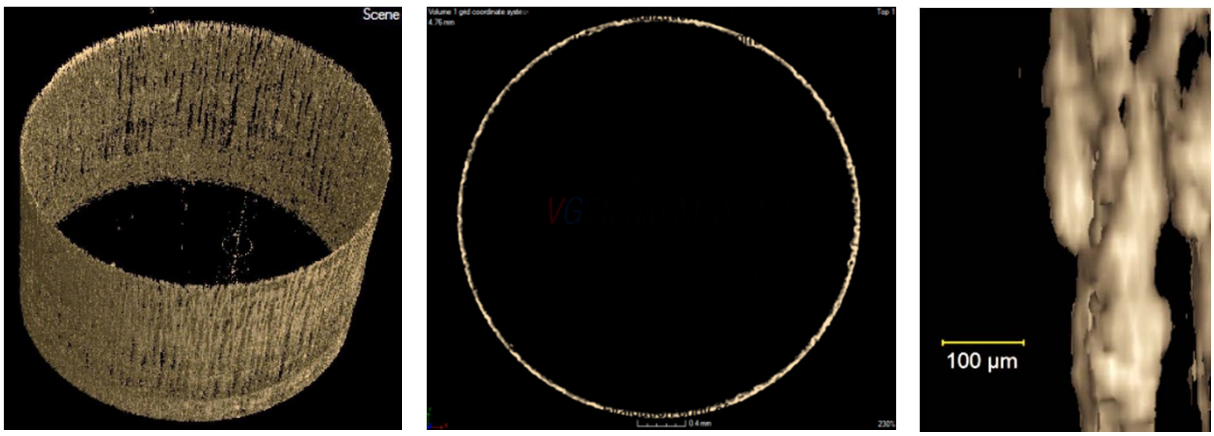
TomoTU – Chair of Magnetofluiddynamics,
Technical University of Dresden, Germany

Tomography measurements using a frozen sample



Three-dimensional reconstructed tomography images of frozen CMF 2.5% sample

Tomography measurements using samples in a magnetic field



Three dimensional reconstructed X-ray microcomputed tomography images of the magnetic field induced Fe particle structure in the nano-micro composite fluid volume

- Borbáth T., Borbáth I., Günther S., Marinica O., Vékás L.,Odenbach S., Three-dimensional microstructural investigation of high magnetization nano-micro composite fluids using X-ray microcomputed tomography, Smart Mater. Struct. 23 (2014) 055018 (10pp)

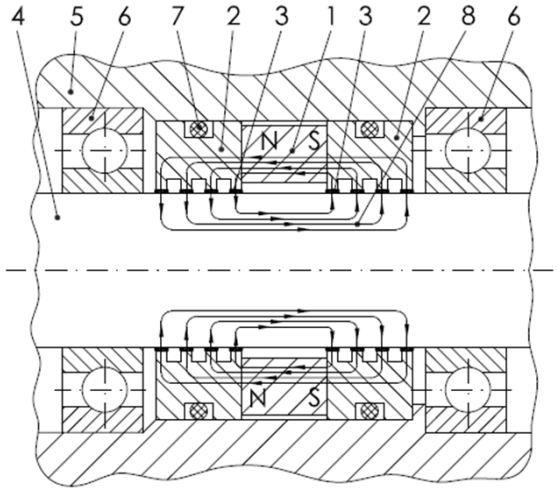
MAGNETIC FLUID SEALS

Magnetic nanofluid rotating seals with a relative simple constructions and special performance are used in many high-tech equipment, including personal computers. Magnetic liquid seals are engineered for a wide range of applications and exposure but are generally limited to sealing gases and vapors, not direct pressurized liquid.

Benefits:

- Hermetic Sealing
- Long Life
- High Reliability
- Non-Contaminating
- High-Speed Capability
- Optimum Torque Transmission
- No Set-Leakage Failures
- Smooth Operation

CONSTRUCTIVE DETAILS



Main components:

1 – permanent magnet
2 – Pole pieces (soft magnetic materials)
3 – Magnetic nanofluid
4 – Shaft (ferromagnetic material)
5 – Housing (nonmagnetic material)
6 – Bearings
7 – "O" ring
8 – Magnetic flux

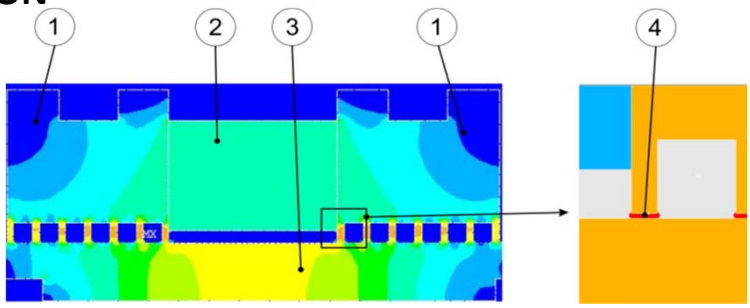
The design of magnetic nanofluid rotating seals bases on the fact, that magnetic nanofluids react as a homogenous liquid in the presence of an external magnetic field and its shape and position can be controlled by a magnetic field gradient.

MAGNETIC FLUX DENSITY DISTRIBUTION

Magnetic circuit design is a critical point in the development of magnetic fluid seals.

Burst pressure of a sealing stage:

$$\Delta p \cong M_s(B_{max} - B_{\min})$$



1 – pole pieces; 2 –permanent magnet; 3 – shaft;
4 – magnetic nanofluid;

MAGNETIC FLUID SEALS

Difference between using magnetic nanofluids and composite magnetic fluids in leakage-free rotating seal systems

The belowed table shows that meanwhile CFMs are adequate for low rotational speeds and for high pressure differences, MNFs can be used for high rotational speeds and for moderate pressure differences.

Synthesis of the effect of the properties of the magnetic nanofluids and magnetic composite fluids on the operating parameters of the magnetofluidic seals

Operating parameters	Properties	MNF with moderate hydrodynamic volume fraction	MNF with high hydrodynamic volume fraction	Magnetizabile composite fluid
Sealing capacity	Saturation magnetization	$\Delta p < 15$ bar	$\Delta p < 30$ bar	$\Delta p < 100$ bar
	Agglomeration	Negligible effect	Negligible effect	Negligible effect
	Sedimentation	–	–	Moderate negative effect
Pheriperal speed	Saturation magnetization	Strong positive effect	Strong positive effect	Strong positive effect
	Viscosity + Magnetorheological effect	< 20 ms^{-1}	< 10 ms^{-1}	$< 1 \div 2$ ms^{-1}
Viscous heating	Viscosity + Magnetorheological effect	Negligible effect	Moderate negative effect	Strong negative effect
Starting torque	Viscosity + Magnetorheological effect	Negligible effect	Moderate negative effect	Strong negative effect

MAGNETIC FLUID SEALS

TESTING MAGNETIC FLUID SEALS

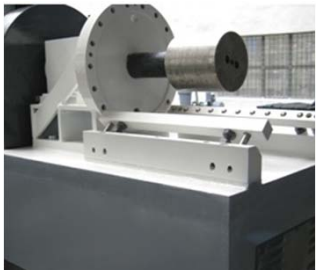
In order to determine the operating parameters of the magnetic fluid seals, an experimental stand was built at the Roseal Co. Odorheiu Secuiesc.

Main measurement parameters:
Seal diameter: max.: 240 mm
Rotational speed: up to 3000 rot / min
Test pressure: 10^{-7} bar - 50 bar

Electrical energy supplying and command module

Pressure module

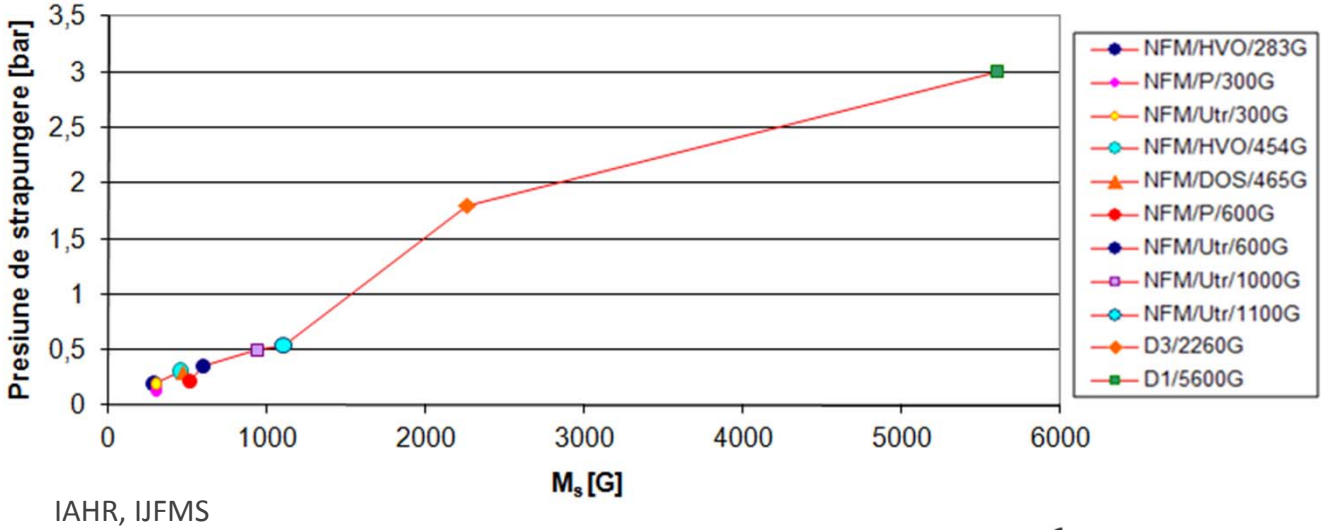
Test module



Vacuum module

Acquisition, transmission, recording and processing data module

SEALING CAPACITIES OF DIFFERENT TYPES OF MAGNETIC NANOFLUIDS AND NANO-MICRO STRUCTURED COMPOSITE MAGNETIC FLUIDS



IAHR, IJFMS

S.C. ROSEAL® S.A.

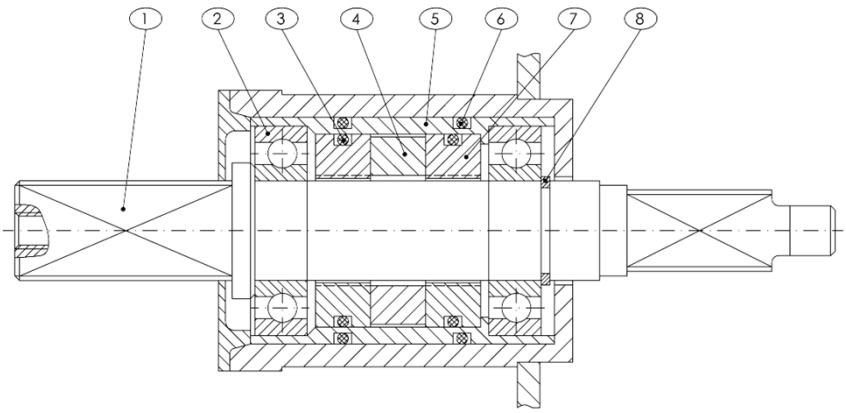
MAGNETIC FLUID SEALS

Some example of custom engineered magnetic fluid seals designed and produced by the Roseal Co. Odorheiu Secuiesc in cooperation with the Lab. Magnetic fluids - CFATR, Romanian Academy – Timișoara Branch and the Research Center for Engineering of Systems with Complex Fluids – UP Timișoara, as well as their applications are presented below.

Static or low speed magnetic nanofluid seals

Magnetofluidic seal for high power electric switches

Temperature: - 33 °C..70 °C
Pressure:10^{-6} – 7 bar



Components:
1- shaft;
2- ball bearing;
3,6- "O" ring;
4- permanent magnet;
5- non-magnetic casing;
7- polar piece;
8- safety ring.

This kind of feedthrough was designed especially for high power electric switches that use SF6 gas to impede the formation of electric arc at switching-off. For safety reasons the leakage of SF6 has to be avoided for the full operating period (several years) of the switch with rotating shaft in a pressure range between 10^{-6} to 7 bar

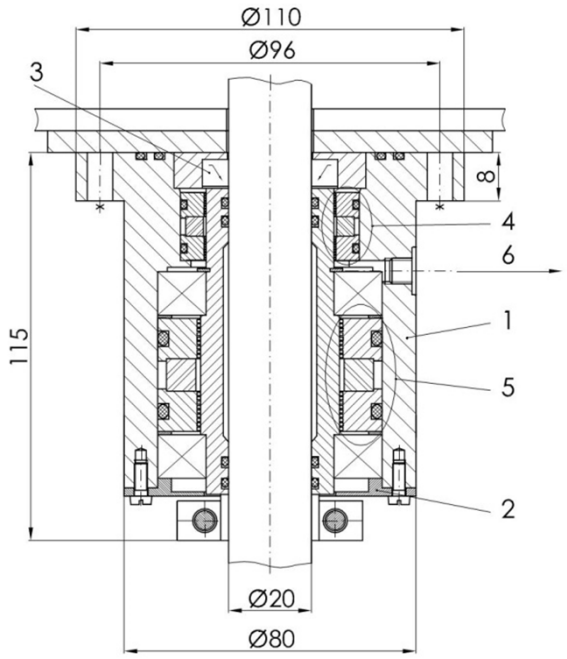
Magnetofluidic seals for vacuum deposition systems

To assure a hermetic sealing of high vacuum (up to $5 \cdot 10^{-7}$ Torr) deposition systems combined seal was designed, where the pressure difference is distributed on two magnetofluidic seals. To keep a low pressure difference on the primary MF seal, the chamber between the two seals is connected to a preliminary vacuum pump.

MAGNETIC FLUID SEALS

Tandem magnetic nanofluid seals

Tandem magnetic nanodluid seals for vacuum deposition systems



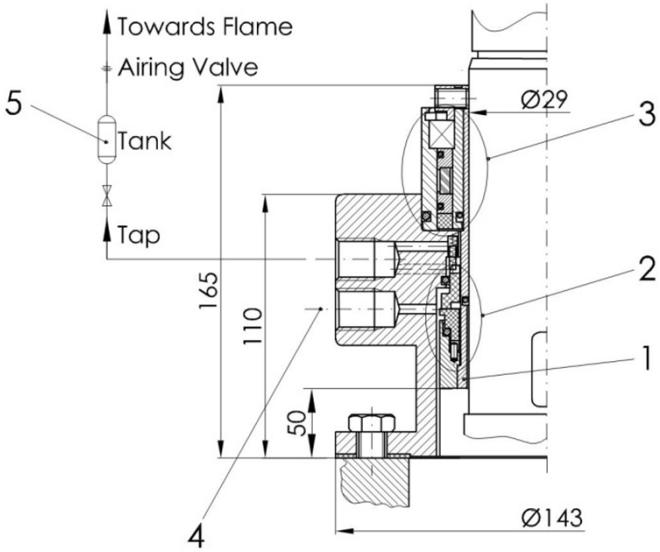
Ultra-high vacuum: $5 \cdot 10^{-7}$ Torr

Components:
1 - non-magnetic house
2 - magnetically soft sleeve
3 - friction seal
4 - primary magnetic fluid seal
5 - secondary magnetic fluid seal
6 - to preliminary vacuum pump

Offers relatively high sealed pressure difference and long-term leakage-free operating regime.

Mechanical – magnetic fluid tandem seal for liquefied gas pump

Application domain: vertical axis pumps for liquefied gas



Pressure: up to 40 bar
Rotational speed: 3000 rot/min

Components:
1- shaft
2- mechanical seal
3- magnetic nanofluid seal
4- inlet for cooling and lubrication fluid
5- system for escaped process fluid evacuation;

- *Eliminate the miscibility of two liquids and/or due to foaming process*

MAGNETIC FLUID SEALS

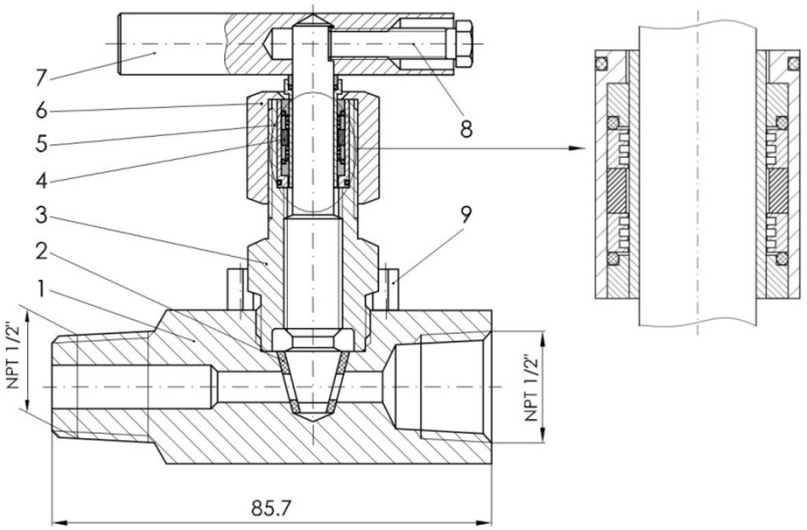
Innovation Program
Contract No. 58 /2007
2007-2010

Research project: SEMAROGAZ

Gas valves up to 40 bar

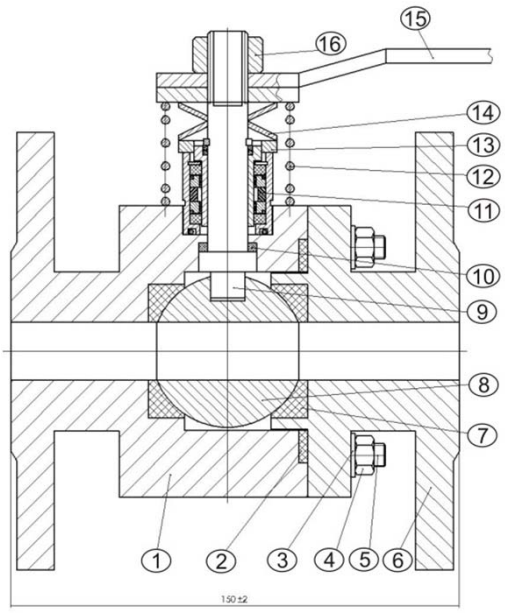
- equipped by a sealing system using high magnetization magnetic nanofluids or magnetic composite fluids;

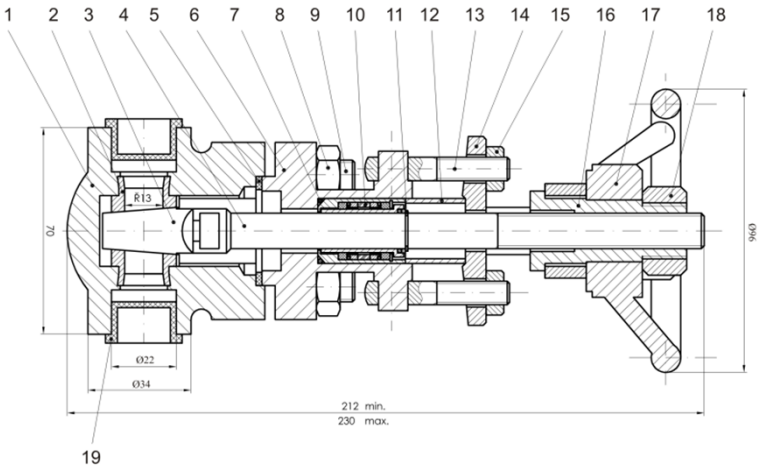
- Independent open-close cycle lifetime;
- leakage-free operating regime;



Components:

1. Body
2. Valve seat
3. Guide
4. Magnetic fluid seal
5. Bar (Valve stem)
6. Stuffing box
7. Valve Handle
8. Screw
9. Spiral elastic suspension pin





Borbáth T., Bica D., Potencz I., Borbáth I., Boros T., Vékás L., Int. J. Fluid Mach. Sys., **4** (2011) No. 1, p.67-75

CARBON MATERIALS

Managing Authority of Operational Programme
'Increase of Economic Competitiveness'
- Programme Co-financed by the European Regional Development Fund -
Advanced research for preparation of thermoresistanct carbon materials exposed to radiation with incresead life-time for sealing gaskets
ID/SMIS: 1092/32296
"INVESTITII PENTRU VIITORUL DUMNEAVOASTRA"

Contract no. **330/14.07.2011**
Acronym: **CARBOTIR**
Programme: **Sectoral Operational Programme "Increase of Economic Competitiveness" (POS CCE), Axa II, Operatiunea 2.1.1**
Duration: **24 months**
Contracting Authority: **co-financed by European Regional Development Fund, concluded with the National Authority for Scientific Research , as Intermediary Organisms, and in the name of the The Ministry of Economy, Commerce and Business Environment as Managing Authority.**

Main objective: increasing the level of technological development of ROSEAL Co. by promoting transfers of research results and scientific knowledge.

Total project costs: 708.946 lei
Non-reimbursable financial assistance: 258.685 lei
ERDF Grant eligible amount: 214.708,55 lei
Grant eligible amount of the national budget: 43.976,45 lei
Ineligible amount of project: 204.815 lei

Requesting company: **S.C. ROSEAL S.A. Odorheiu Secuiesc**
Project Director: eng. Istvan **Borbath**
Research organisation: **National Institute for R&D in Electrical Engineering ICPE-CA Bucharest**
Project responsible: Kappel **Wilhelm**

For detailed information about other programs co-financed by the European Union, please visit **www.fonduri-ue.ro**

CARBON MATERIALS

CEEX Program
Contract No. 88 / 2005
2005-2006

Project name:

Low cost alternative multifunctional materials for fuel cells with electrolyte polymer operating at temperatures above 180°C

Project conductor:

INCDIE ICPE-CA BUCHAREST

Partners:

S.C. ROSEAL S.A. ODORHEIU SECUIESC

Results:

Materials:

- Expanded graphite type B5
- Fluorocarbon rubber type S3
- Composite graphite material type B8
- Composite graphite material type B14
- Composite graphite material type B1

Seal gaskets and bipolar plates:

- Seal gasket made from B5 type expanded graphite material
- Seal gasket made from T1 type sintered politetrafluoretylen material
- Seal gasket made from S3 type fluorocarbon rubber material
- Seal gasket made from S1 type silicone rubber material
- Bipolar plates made from B8 type carbon materials composite
- Bipolar plates made from B14 type carbon materials composite
- Bipolar plates made from B1 type carbon materials composite

HYDROGEN FUEL CELLS

Hydrogen Fuel Cells– 5KW

Programme INOVARE
Contract no. 21-034/2007
2007-2010

Project name:

INTEGRATED ENERGETICAL MODULE WITH 5KW POWER BASED ON FUEL CELLS.

Project conductor:

INCDIE ICPE-CA BUCHAREST

Partners:

POLITEHNICA UNIVERSITY OF BUCHAREST

S.C. ROSEAL S.A. ODORHEIU SECUIESC

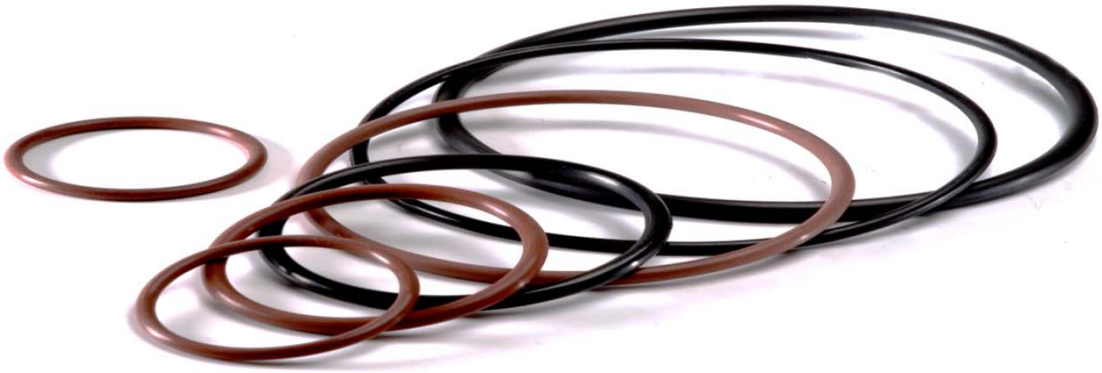
SC CHIMCOMPLEX SA BORZESTI

Specific objectives

Designing the integrated energetical module, having on the basis a fuel cell stack with a total power of 2500 W (total electrical power: 100 We, total thermical power; 1500 Wt). The average working temperature is 60 °C and the maximum admissible working temperature is 80 °C. The temperature of the stack is controlled by a thermal aqueous agent (deionization water, ethylene glycol) which is recirculated in the system. Used combustible: hydrogen. Used oxidant: air. The supplied voltage of the stack is between 24V - 9 V. The maximum current is 12 0Acc.

The variable voltage of the fuel cell stack output is stabilized through a DC/DC converter and transformed through an DC/AC 220 Vac/50 Hz inverter .

ELASTOMERS



Contract no. **235/2008**
Programme: **INNOVATION**
Project title: "**Heat-proof polymer materials with increased lifetime for seal gaskets exposed to radiation**"
Contract duration: **19 months**
Contracting Authority: **Management Agency for Research, Innovation and Technology Transfer, POLITEHNICA from Bucharest**
Acronym: **MAPOLETIR**
Consortium:

CO S.C. ROSEAL S.A. Odorheiu Secuiesc
Project director: eng. István **Borbáth**
P1 INCDIE ICPE-CA Bucureşti
Project responsible: Dr. Traian **Zaharescu**

Main objective: Development of special quality seal gaskets with increased life-time for mechanical seal systems for a wide range of pump applications, which operate at high temperatures and are exposed to radiation, having direct application in the nuclear industry.

Competivity level: The project gives possibility for achieving a highly stable material in the most favorable condition, being competitive on the narrow market segment of the polymers for nuclear applications.
Materials and products characterized in this project possess appropriate quality for the current requirements of the nuclear safety.
Durability of the tested compositions (elastomer-antioxidant) allows to extend the range of application areas to the energy sector which require high resistance for degradation.

ELASTOMERS

Innovation Program
Contract No. 235/ 2008
2008-2011

Research Project MAPOLETIR

Degree of novelty

Compositions of ethylene-propylene elastomer have been made, composites with hindered phenolics concentration (2%), optimized, tested to extreme conditions of the nuclear area.

Mapoletir 1 is a polymeric material, an ethylene-propylene elastomer combined with **KELTAN 5580** and stabilized with **Ethanox 330**. The concentration of the stabilizer additive is 2% by weight.

Mapoletir 2 is a polymeric material, an ethylene-propylene elastomer combined with **KELTAN 5580** and stabilized with **Irganox 1010**. The concentration of the stabilizer additive is 2% by weight.

Mapoletir 3 is a polymeric material, an ethylene-propylene elastomer combined with **KELTAN 834** and stabilized with **Ethanox 330**. The concentration of the stabilizer additive is 2% by weight.

Durability of materials were determined by measuring the intensity of chemiluminescence emission. The material behavior were investigated at temperatures for a thermal regime characterized by temperatures in the range 170 – 220 °C to thermal degradation initiated by prior exposure to radiation in order to know the synergistic effect of thermal energy and ionizing on the durability of the elastomers. A comparative analysis were performed of the radio-induced thermal decomposition behavior for two similar materials, which differ in the concentration of diene as a constituent of macromolecular skeleton. We assessed the stabilization efficiencies equivalent compositions without stabilizer to correlate the effect of antioxidants and molecular structures of the polymer base material. S-au evaluat eficienţele de stabilizare pentru compoziţii echivalente fără stabilizatori pentru a corela efectul antioxidanţilor şi a structurilor moleculare ale materialelor polimerice de bază.

Hardenss [Shore A]	75±5
Tensile strength [daN/mm^2]	Min 120
Elongation at break [%]	Min 300

Material	**Lifetime in radiation of 5 kGy (30°C) years**
Mapoletir 1	35
Mapoletir 2	44
Mapoletir 3	14
Mapoletir 4	22

Zaharescu T., Jipa S., Mantsch A., Borbath I., Borbath T., Qualification of ethylene-propylene elastomers for nuclear applications, Journal of Advanced Research in Physics **1** (2010) 1

EVENTS

WORKSHOP AND CONFERENCES

7 – 8th of November 2013, Bucharest – Romania
2013 IEEE Workshop Integration of Stochastic Energy in Power Systems

24 – 25th of May 2012, Bucharest – Romania
Dorin PAVEL Conferinţa Hidroenergeticienilor din România
Presentation: ***Experiments on viscous heating in leakage-free rotating seal systems with magnetic nanofluid***
(http://www.scientificbulletin.upb.ro/rev_docs_arhiva/full013_548628.pdf)

2 – 3rd of June 2011
Workshop "Multifunctional nanoparticles, magnetically controllable fluids, complex flows and applications", **"Timișoara Academic Days"**, organized by the Laboratory of Magnetic Fluids, Romanian Academy – Timișoara Branch
Presentation: ***High magnetization magnetizable fluids used in leakage-free rotating seal systems***

24 – 26th of May 2011, Bacau – Romania
OPROTEH - The 9th International Conference OPROTEH – 2011
Presentation: ***Influence on the leakage flow rate of the stationary seal ring shape of the mechanical seal systems used in feed pumps in the power plants*** (http://journaldatabase.org/articles/influence_on_leakage_flow_rate.html).

21 – 23rd of March 2011
EUROMECH Colloquium 526 "Patterns in Soft Magnetic Matter"
Poster: High magnetization magnetizable fluids used in rotating seals.

20 - 24th of September 2010, Timisoara – Romania
25th IAHR SYMPOSIUM ON HYDRAULIC MACHINERY AND SYSTEMS
Presentation: ***Magnetic fluids and magnetic composite fluids in rotating seal systems*** (http://iopscience.iop.org/1755-1315/12/1/012105).

EVENTS

WORKSHOPS AND CONFERNECES

2 – 4th of September 2010, Odorheiu Secuiesc – Romania
CEM 2010 - Cel de al 7lea Workshop International de Compatibilitate Electromagnetică CEM 2010, organized by the National Institute for R&D in Electrical Engineering ICPE-CA

10 – 12th of September 2009, Bucharest – Romania
The Workshop "Innovation and Evolution by R&D - SMEs Strategic Partnership" 2009
Presentation: ***Research projects at Roseal Co.***

2 – 6th of June 2009, Timisoara - Romania
Workshop on Smart Fluids and Complex Flows, **"Timișoara Academic Days",** organized by the Laboratory of Magnetic Fluids, Romanian Academy – Timișoara Branch
Presentation: Rotating seals with magnetic fluids for special uses: some constructive details and testing procedures

24 – 25th of May 2007
10th Edition of Academic Days Timișoara

29th of June – 3rd of July 1998
8th International Conference on Magnetic Fluids

EVENTS

WORKSHOPS AND CONFERNECES

9th of September 2008, Odorheiu Secuiesc - Romania

Workshop of Magnetic nanofluids and applcations in the field of high performance rotating seals, organized by Roseal Co.

Presentations:

- Design, construction and operation of a test stand for testing magnetic fluid sealing capacity
- Micropilot scale production of magnetic nanofluids. Implementation of high level technologies at Roseal Co.

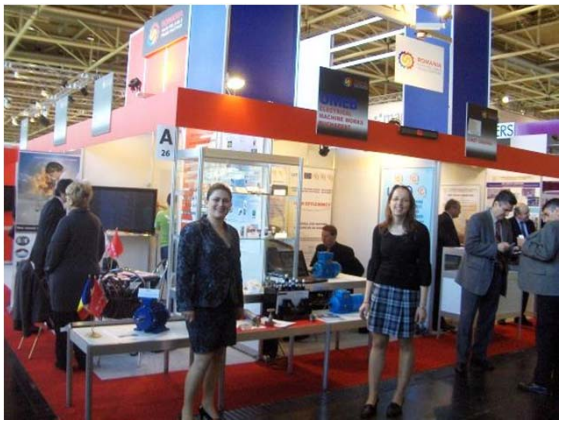
EVENTS

TRADE FAIRS

6 – 9th of October 2010, Bucharest, Romania
Bucharest International Technical Fair– TIB INOVARE
Exhibition of Romanian Research Achievements
Salon of research, Romexpo, Pavilion 13

3 - 6th of May 2010, Bucharest, Romania
Bucharest International Technical Fair - TIB

20-24th of April 2009 Hannover, Deutchland
Hannover Messe



EVENTS

TRADE FAIRS – CERTIFICATES

26 – 31st of October 2009, Bucharest, Romania

Inventika

2 – 6th of October 2007, Bucharest, Romania

Bucharest International Technical Fair

Contract CEEX no. 83/2006

5 – 8th of October 2011, Bucharest, Romania

Inventika

Contract PNCD II no. 21-043/2007

SCIENTIFIC PAPERS, PATENTS AND RESEARCH PROJECTS

SCIENTIFIC PAPERS

- I. Borbáth, Z. Kacsó, L. Dávid, I. Potencz, D. Bica, O. Marinică, L. Vékás, Applications Of Magnetic Nanofluids In Rotating Seals*, Convergence of micro- and nanoengineering*, Bucharest; Romanian Academy Publ.House (2006), pp. 200-10 http://roseal.eu/kep/MNFseals_lucrareROMJIST.pdf
- A. Hajdú, E. Illés, E. Tombácz, I. Borbáth: Surface charging, polyanionic coating and colloid stability of magnetite nanoparticles, *Colloids&Surfaces A.* 347 (2009) pp.104–8, http://dx.doi.org/10.1016/j.colsurfa.2008.12.039
- D. Susan-Resiga, O. Marinică, L. Vekás, T. Boros, Flow behaviour of extremely bidisperse magnetizable fluids, *Proceedings of CFM 2009 New Trends in Complex Fluids Modeling*, Bran, Romania, ISSN: 2066-5790; UPT (2009) pp. 60-2
- T. Borbáth, D. Bica †, I. Potencz, L. Vékás, I. Borbáth, T. Boros, Magnetic nanofluids and magnetic composite fluids in rotating seal systems, *Proc. 25th IAHR Symposium on Hydraulic Machinery and Systems*, Timisoara, Romania 2010, *IOP Conf. Series: Earth and Environmental Science* **12** (2010) 012105 doi:10.1088/1755-1315/12/1/012105
- T. Zaharescu, S. Jipa, A. Mantsch, I. Borbáth, T. Borbáth, Qualification of ethylene-propylene elastomers for nuclear applications, *Journal of Advanced Research in Physics* **1** (2010) 1 http://stoner.phys.uaic.ro/jarp/index.php/jarp/article/view/27
- T. Borbáth, D. Bica, I. Potencz, I. Borbáth, T. Boros, L. Vékás, Leakage-free Rotating Seal Systems with Magnetic Nanofluids and Magnetic Composite Fluids Designed for Various Applications, *International Journal of Fluid Machinery and Systems* **4** (2011) No. 1, pp.67-75 https://www.jstage.jst.go.jp/pub/html/AY03S050_en.html
- T. Borbáth, V. Panaitescu, I. Potencz, I. Borbáth, L. Vékás, Analiza câmpurilor magnetice în etanşări rotitoare cu nanofluide magnetice*, A XI-a Conferinţă Naţională multidisciplinară – cu participare international "Profesorul Dorin PAVEL – fondatorul hidroenergeticii româneşti"*, Sebeş, **19** (2011) pp. 337-44
- D. Susan-Resiga, V. Socoliuc, T. Boros, T. Borbáth, O. Marinica, A. Han, L. Vékás, The influence of particle clustering on the rheological properties of highly concentrated magnetic nanofluids, *Journal of Colloid and Interface Science* 373 (2012), pp. 110–5 http://dx.doi.org/10.1016/j.jcis.2011.10.060
- T. Borbáth, I. Borbáth, S. Gunther, O. Marinica, L. Vekás, S. Odenbach, Three-dimensional microstructural investigation of high magnetization nano-micro composite fluids using X-ray microcomputed tomography, *Smart Materials and Structures* Smart Mater. Struct. 23 (2014) 055018 (10pp)
- L. Pîslaru–Dănescu, A.M. Morega, M. Morega, V. Stoica,O. M. Marinică, F. Nouraş, N. Păduraru, I. Borbáth, T. Borbáth, Prototyping a Ferrofluid Cooled Transformer, 2012, *IEEE Transaction on IAS* 2011-EMC-581.R2 10.1109/TIA.2013.2252872

SCIENTIFIC PAPERS, PATENTS AND RESEARCH PROJECTS

SCIENTIFIC PAPERS

- T. Borbáth, V.N. Panaitescu, I. Borbáth, O. Marinică, L. Vékás, Experiments on viscous heating in leakage-free rotating seal systems with magnetic nanofluid, *U.P.B. Scientific Bulletin*, Series D, Vol. 75, Iss. 3, 2013
- **http://www.scientificbulletin.upb.ro/rev_docs_arhiva/rez84c_129440.pdf**
- T. Zaharescu, R. Setnescu, I. Borbáth, Thermal stability of magnetic fluids components and systems, *Central European Journal of Chemistry* (2013) (accepted for publication)
- T. Zaharescu, I. Borbáth, L. Vékás, Radiation effects in polyisobutylene succinic anhydride modified with silica and magnetite nanoparticles*, Radiation Physics and Chemistry* (2013) (submitted)

PATENT

- *Bica D., Vékás L., Bălănean F., Borbáth I., Boros T., Gálffy D.,* Procedeu de obţinere a fluidelor magnetice compozite pentru etanşări magnetofluidice rotitoare, pentru presiuni ridicate, 2009, Brevet RO 122725

PATENT REQUESTS

- L. Pîslaru-Danescu, E. Macamete, G. Telipan, J. Pintea, F. Nouraș, N. Păduraru, L. Vékás, F. D.Stoian, I. Borbáth, T. Borbáth, A. Morega, M. Morega, Transformator cu agent de răcire nanofluid magnetic, 2010, Brevet RO Nr. OSIM A 00776-31080
- I. Borbath, Tunde Borbath, L. Vekas, Forma geometrică a etajului de etanşare în sisteme de etanşare cu fluide compozite magnetizabile nano-micro structurate – OSIM no. A/00952.

Acknowledgement

Dr. Doina Bica
1952-2008

The scientific activity of Mrs. Dr. Doina Bica, taken with passion, ingenuity and perseverance for nearly three decades (1980-2008) in the Laboratory of Magnetic Fluids in Timisoara, at the beginning at the Polytechnic University, Department of Hydraulic Machines and then at the Romanian Academy - Timisoara Branch, Center for Fundamental and Advanced Technical Research and at the National Center for Magnetic Fluid Engineering from "Politehnica" University of Timisoara, has meant a fundamental contribution to the chemical synthesis of magnetic fluids, the development and consolidation of magnetic fluid domain in Romania. Her many publications in international scientific journals and collaborations with research teams from the country and abroad, marked important steps towards recognition by the international scientific community of the scientific results obtained in the country regarding to the nanoparticles and magnetic nanofluids, being the current scientific trend of Nanoscience and Nanotechnologies.

She put remarkable effort for implementation on an industrial scale at the Roseal Co. Odorheiu Secuiesc of the synthesis procedures of magnetic nanofluids, that she developed, through which Romania became magnetic nanofluids and magnetofluidic rotating seals producer.

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