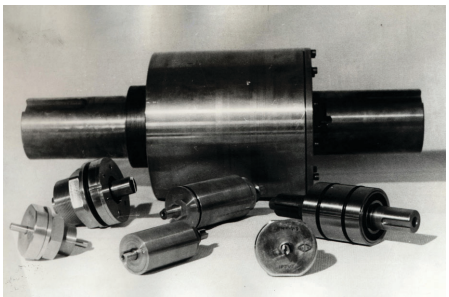
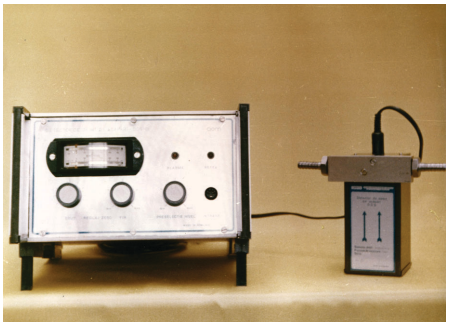
Soft Matter Composites-An Approach to Nanoscale Functional Materials (SOFTCOMP)

Coordinator: Prof. Dr. Dieter RICHTER- Forschungszentrum Juelich, Germany



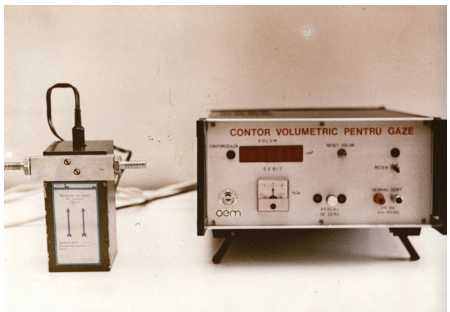
Leakage-free rotating seals with magnetic nanofluids

The central objective of the NoE SoftComp is to unite the presently two-fold fragmented soft matter scientific community into single integrated and outward looking team of the very best European researchers. The present fragmentation along disciplinary and materials lines hampers progress in one of the most promising current fields of material science, where the delicate self-organising principles of polymeric, amphiphilicand colloidal matter are ubiquitous. For example, they create the functional, self-assembling, information-processing and sustainable systems that constitute living organisms. For the first time in the history of our science and technology, we are in the position to support a science and technology that learns from biological organization in structural and functional materials and in some cases goes beyond it. In addressing soft matter composites build from several of the classic soft matter ingredients, SoftComp will integrate the traditionally separated soft matter disciplines, materials and methods.



Magnetofluidic leakage-flow sensor

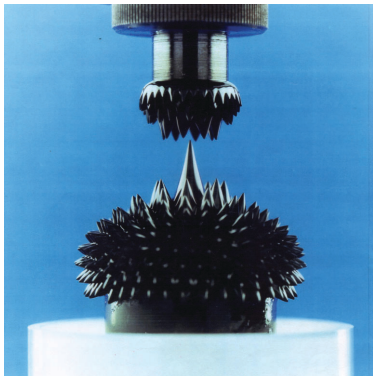
The SoftComp NoE has a highly performant management strategy. Its impact on ERA is achieved from a permanent training strategy involving summer schools, conferences, workshops, exchange of personnel, laboratory training, industrial workshops, material for graduate training and publications. The scientific Joint Programme Activities will focus on ***combinations of soft matter composite materials*** such as colloidal composites, self assembling surfactant systems, complex membranes, liquid crystal hybrid systems, polymer based complex systems, nanocomposites, gels, glasses, films, interfaces, and surfaces.



Magnetofluidic gas flow meter

Romanian associate partner: *Laboratory of Magnetic Fluids-Center for Fundamental and Advanced Technical Research from Timisoara of the Romanian Academy and National Center for Engineering of Systems with Complex Fluids-Univ. POLITEHNICA Timisoara*, contact person: **Prof. Ladislau Vekas** (vekas@acad-tim.utt.ro)

The contributions and long-term experience of Romanian associate partners ***refer to magnetic soft matter composites***: preparation of magnetic nanoparticles; dispersion/stabilization mechanisms; magnetic nanofluids; magnetorheological nano-micro structured fluids; magnetic emulsions, gels, polymeric nanocomposites; structural investigations (TEM, SANS); ferrohydrodynamics; structural processes and flow properties under applied magnetic field; magnetically controlled heat transfer processes; technical applications (leakage-free rotating seals, sensors, transducers, semi-active dampers, bearings); biomedical applications (bioactive magnetic nanocomposites for plant cell biology and veterinary medicine).



Magnetic nanofluids properties

In-Situ Study and Development of Processes Involving Nano-Porous Solids (INSIDE_PORES)

Coordinator: Dr. Nick Kanellopoulos, National Center for Scientific Research "Demokritos", Greece

Participants:
A very large research team, of which 14 represent **Core Groups** and 25 **Satellite Groups**.

Objectives:

- To assembly a critical mass of expertise in the field of porous materials used as catalysts, catalyst supports and membranes, and in new technologies involving energy storage, novel reactions, etc;
- To develop methodologies for in situ application of both static and dynamic techniques and their combinations as tools for probing the evolution of properties relevant for specific processes involving nanoporous solids. These processes span from synthesis of materials (where particle size, control crystallization kinetics, etc. play a significant role in the product) to their final application (where the evolution of the processes occurring in the porous structure is critical)

Such studies, including modelling, are viewed as the starting point for the development of alternative new : "smart" industrial processes.

Activities are built on four interdisciplinary, process related, working cornerstones: Synthesis, Sorption (Separation/Storage), Membranes and Catalysis

The Core Groups are represented by prestigious groups from research institutes and university departments from France, Italy, UK, Norway, Netherlands, Germany and Spain. Common application for funding in other schemes of UE is envisaged.

The Satellite Groups (acting for the moment on voluntary basis) contain representative groups of research institutes and companies from France, Germany, Greece, Hungary, Italy, Netherlands, Poland, Romania, Slovenia, Spain, UK.

Activities in the NoE project INSIDE PORES:

- *(i)* Oxidation/combustion/environmental catalysis (catalysts preparation/characterization/testing and mechanistic studies) on nanosized oxide catalysts and supports. *(ii)* Studies of gas adsorption by in situ AC electrical measurements, by using DFT (differential steps technique), elaborated in the Laboratory of Chemical Kinetics, and in which the group has a tradition of 20 years.
- Other nano-materials characterization by AC ***in situ*** measurements.

Romanian associate partner:
Group of Heterogeneous Kinetics of the Laboratory of Chemical Kinetics, Institute of Physical Chemistry "I.G.Murgulescu" of the Romanian Academy; contact person: ***Dr. Monica Caldararu***, **mcaldararu@chimfiz.icf.ro**

Romanian team: The group is composed of six young scientific researchers and research assistants (all of them PhD students) and two senior researchers.

General Research Topics of the Romanian group:
(i) oxidation catalysis on oxide and oxide supported catalysts ;(ii) environmental catalysis, (iii) oxides as gas sensors and mechanisms of catalytic sensing; (iv) ***in situ*** studies of electrical behavior of semiconductor oxides used as catalysts and as sensors.