surface of coating and corresponds to "size" effect, charactering for nanoparticles. This effects is demands more careful studying as experimental methods, so theoretical interpretation.

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Keywords: Nanostructure, Oxide Films, Plasma-Electrolytic Oxidation, Catalysis

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Nano-microstructured high magnetization complex fluids

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Magnetic nanofluids (MNF) (or ferrofluids) are ultrastable colloidal systems of magnetic nanoparticles, usually of magnetite, dispersed in various non-polar and polar carriers. Numerous engineering and biomedical applications benefit of the unique properties of these smart fluids, however some of them are restricted due to the upper limit of the saturation magnetization of commercially available ferrofluids of about 50 kA/m. Magnetorheological fluids (MRF) which have up to an order of magnitude higher magnetization, are suspensions of micrometer range ferromagnetic (iron)particles and gave rise to a wide variety of applications especially in semi-active damping devices, exploiting the field induced, up to three orders of magnitude large reversible viscosity increase of these fluids. Limitations in applications are originating in fast gravitational settling of particles and sometimes in their reduced re-dispersing capabilities.

The magnetizable fluids presented in this work were prepared taking into account that the relative strengths and ranges of various interaction potentials can be controlled by the sizes of magnetic particles. High magnetization and well stabilized transformer oil based ferrofluids with magnetite nanoparticles of mean size below 10 nm were used as carrier liquids for suspensions of micrometer range iron particles. We investigated the magnetic, rheological and magneto-rheological behaviour of extremely bidisperse (nano-micro) magnetizable fluids (D samples), which keep their stability in magnetic field. The saturation magnetization and magneto-viscous response of D-samples were controlled by the magnetization of the ferrofluid carrier and by the volume fraction of multi-domain micrometer size iron particles. The flow curves in the absence and in the presence of magnetic field are strongly dependent on the fluid composition. The magnetic and non-Newtonian flow behaviours of D-fluids were tuned by using different fractions of nanosized magnetite and micron-sized iron particles and are fitted with various models of complex fluid flow.

Keywords: Magnetizable Composite Fluid, Ferrofluid, Flow Properties, Magnetic Properties

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Hybrid nanostructures synthesized by supersonic molecular and cluster beams: The perspective of sensing devices exploiting their novel functional properties

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A variety of approaches are aimed at developing functional nanocomposite hybrids with the basic idea of engineering the interfaces and interactions of the organic and inorganic counterparts at the nanoscale. The great versatility of such materials opens a wide range of applications including optoelectronics, gas sensing, biofunctionality, etc.
We introduce a novel approach to the synthesis and growth of nanostructured organic-inorganic hybrids based on the co-deposition from Supersonic Molecular Beams seeded by molecules and clusters (SuMBE). We independently showed that SuMBE gives unprecedented control on reactivity and structure of: a) organic π-conjugated molecules (Pentacene, Porphyrines and to control the growth of hybrid organic-inorganic thin films; b) the synthesis of nanocrystalline films of oxides TiO_2 (without any thermal process), c)the ability to activate chemical processes cinematically by tuning the kinetic energy of the precursors in the beam. The newly developed system allows the simultaneous deposition of metal oxides and organic molecules. In this new concept and experimental set up three supersonic beams can be used at the same time, together with a conventional Knudsen cell. The surface and interface electronic properties (UPS, XPS) show the successful ability to synthesize stable hybrid nanostructures such as nanocrystalline TiO_2 decorated with organic pi-conjugated molecules (phtalocianines) and organolantanide structures formed by organic macrocycle (porphyrin) and erbium. The nanohybrids are formed by reactions activated by both the kinetic energy of the molecules and the strong reactivity of the inorganic clusters. Their novel functional properties have been demonstrated by gas sensing devices showing an enhanced specific response to, i.e. NOx, of 104 times due to the electron transfer occurring between the inorganic nanostructure and the molecule. The perspective is a new class of nano-hybrids with controlled novel functional properties for applications in sensing and opto-electronic devices.

Keywords: Pi-Conjugated Molecules, Nanocrystalline Oxides, Thin Film Growth

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