PARTNER SEARCH FORM

GENERAL DESCRIPTION

Ref:	09-IAN-903
Deadline for responses	02/02/09
Title:	Nanostructured Oxides Exhibiting Multi-Ferroic Properties (NanoMFerroics)
Abstract:	Our research relates design-synthesis and systematic investigation of the physics in electronically correlated materials. The proposal employees bottom up engineering for metal-oxide-nanoparticle-based architectures with more than one primary ferroic order parameters in a single nanomaterial. The efficiency of interface-enhanced phenomena in magnetoelectronics is studied by fabricating prototype spin-valve structures. The industry should demonstrate the technological prospects of the proposal.
Description:	In many device applications of spintronics, sensor, photovoltaics, data storage, drug and biological/medical industries, there is urgent need for multifunctional materials that could improve upon the device efficiency. The coupling between primary ferroic order parameters (PFOPs) offers such a possibility because it facilitates the inter-conversion of energies stored in strain, electric and magnetic fields playing thus an important factor in such applications. NanoMFerroics aims in exploiting synthetic routes which can lead to the production of chemically accessible and readily processable nanomaterials, cheaply scaled up to milligram-to-gram quantities that would enable their implementation into disparate technologies. We propose to demonstrate a general and versatile bottom-up approach to generate, tailor and manipulate magneto-opto-electronic properties by means of colloidal inorganic nanomaterials based on multiferroic/magnetoelectric (MF/ME) transition-metal oxide combinations. The goal of project is to create a common core platform based on the exploitation of hybrid MF nanocrystals (HMFNCs) with a topologically defined composition. These will lay the foundations for accessing innovative classes of nanocrystal-enabled PFOP-based concepts and technologies; the latter including spintronics, sensor, electronics, photovoltaics, data storage and even biological targeting or labelling. Since interfaces will be the key control parameter of the end property, we will address and establish interfaces as sources of new or modulated magnetic and/or electric behaviour. The approach will represent a research solution toward tailored PFOPs, which go beyond the state-of-art nanoparticle-related technology that so far has exploited mainly nanoparticle size and shape related effects. This approach is expected to lead into the creation of systems with emergent phenomena. Our primary emphasis will be focused on the implementation of HMFNCs into spin transport device prototypes: We plan to use HMFNCs in spin-based devices employing: (i) FM/HMFNC/FM junctions (FM= ferromagnetic) in spin-valve architectures and HMFNC-based spin-transistor; (ii)

STEP-C, 100 N. Plastira Str., 700 13
Vassilika Vouton, Heraklion, Crete, Greece
Tel.: +30 2810 391954, Fax: +30 2810 391906
e-mail: crete@help-forward.gr
http://www.help-forward.gr

	MT/HMFNC/MT junctions (MT= noble metal) with tunable magnetoresistance and (iii) junctions using conductive HMFNCs as FM leads to inject (and analyze) spin-polarized currents in dimer-like structures, each consisting of one magnetic HMFNC, a bridging conjugated molecule, and another HMFNCs. The project may be divided in six workpackages which are expected to be developed in parallel and through complementary fashion throughout the duration of the project: 1. The synthesis of new generations of HMFNCs 2. The structural and magneto-opto-electronic characterisation of HMFNCs 3. Demonstration of PFOP-coupling and their effect in the control of spin 4. Theoretical calculations of magneto-opto-electric properties of HMFNCs 5. Implementation of HMFNCs into spin-valve prototypes 6. Development and advantages of spin-controlled circuitry at industrial level We aim to achieve independent control over interfaces in chemically synthesized nanostructures, from which unconventional, virtually unlimited (as many organic/inorganic associations are possible in principle) magnetic properties can be extracted with potential application in electronics.
Keywords	ELECTRONICS, IT and TELECOMMS Electronics, Microelectronics Electronic circuits, components and equipment/ Electronic engineering Magnetic and supercoductory materials/ devices Printed circuits and integrated circuits Semiconductors

EUROPEAN FUNDING SOURCE

EC Programme(s)	FP7 - Cooperation Nanosciences, nanotechnologies, materials & new production technologies
Type(s) of Project	Large scale integrating project (FP7-NMP-2009-2.2-1)
Development Stage	Proposal under development

ORGANISATION/COMPANY

Organisation Type	Research Institute
Organisation Size	>500
Description of activities/other details	The greek institute aims at performing high quality research (both fundamental and applied) in specific target areas in the fields of physics, chemistry, and materials science. Specifically, the institute's research activities span over the fields of Lasers and Applications, Materials Science, Microelectronics and Devices, Environmental Research, and Theoretical and Computational Physics and Chemistry.

TARGET PARTNER

Target Partner Organisation Type(s)	SME or Large Company
Target Partner Expertise Sought	Expertise: Opto- or Magneto- Electronics, Electronic Engineering, Data Storage, Actuators (e.g. magnetoresistive, piezoelectric etc), Energy conversion, Biomedical targeting or delivery, Telecommunications Specific task to undertake in the project: Development of spin-controlled circuitry based on selected HMFNCs (at larger scale), as well as demonstration of those key functions that present certain advantages, as compared to the manufacturing of systems based on Si technology. More specifically, implementation of new nanostructures that are going to be prepared in end-products or applications; such as in magnetoresistive or magnetostrictive devices, where the manipulation of the magnetization is carried out by external stimuli (e.g. electric/magnetic field, light, current etc).
Application Domain(s):	Industrial manufacture, Materials technology, Electronics, Microelectronics, Energy, Biotechnology, Medicine, Environment protection

Contact:

Dr Apostolos Dimitriadis
HELP-FORWARD Network / Diktyo PRAXI
Member of Enterprise Europe Network - Hellas
STEP-C, N.Plastira 100
GR - 70013, Vassilika Vouton
T: +30 2810 391963
F: +30 2810 391957
e: adimi@hel-forward.gr