# $T_C$SUH Bi-Weekly Seminar

Texas Center for Superconductivity at the University of Houston


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## Development of Nanostructured Systems for Energy, Environmental and Biomedical Applications

**Friday, September 18, 2009**
Room 102, University of Houston Science Center
12:00 Noon – 1:00 p.m.


## Abstract

The main topic of this presentation will focus on development of nanostructured particulate systems and fabrication of advanced devices for power systems, energy storage, environmental protection, national security and health care. I will present novel nanoenergetic systems that have the potential to enable a more concentrated energy release and potentially can be used for various military applications such as an actuation parts, igniter, propulsion unit, gas-generators as well as an active part for high power electromagnetic pulse generators. I will describe a novel cost-effective and energy efficient production of nanostructured complex oxides that we referred to as Carbon Combustion Synthesis of Oxides (CCSO). In this process, the reactive oxidation of carbon/graphite nanoparticles generates a steep thermal wave (temperature gradient of up to 500 °C/cm) that propagates through the solid reactant mixture (oxides, carbonates or nitrates) converting it to the desired products. The high rate of gas release enables synthesis of highly porous complex oxides having a particle size in the range of 50-800 nm. The experimental results of fabrication of various systems such as hard and soft magnetic materials, superconductors, multiferroics, bulk ceramic resistors, capacitors, photocatalysts with p-n junction, MRI contrast agents and cancer hyperthermia will be presented. Key factors that affected to the device characteristics (magnetization, conductivity, magnetic resonance relaxivity and other) will be discussed. Finally, I will describe a novel medical device that we referred to as Encapsulated Contrast Agent Marker (ECAM) for MRI cancer prostate brachytherapy (PB). While MRI is the modern superior imaging modality, for cancer treatment it is currently not used in PB because the implanted radioactive titanium seeds appear artifacts (negative contrast) and cannot be accurately localized within the prostate and periprostatic tissue. The innovative development of an MRI visible ECAMs technology will provide a precise targeted magnetic resonance imaging for PB and can impact over 200,000 in US (12,000 in Texas) men diagnosed annually with localized prostate cancer. Development of this emerging technologies warrant a multifaceted approach, which includes interdisciplinary collaboration, partnerships with industry and academia, and integration of modern problems into our curriculum.


## Bio

Research assistant professor Karen Martirosyan joined the University of Houston, Chemical & Biomolecular Engineering Department in 2001. He earned his BS and MS degree in Electrical Engineering/Medical Cybernetics from the State Engineering University of Armenia and Ph.D. in Chemical Engineering from the Russian Academy of Sciences. Dr. Martirosyan's research interests are focusing on the use of innovative chemical reactions to design novel nano-tailored materials and systems for energy, environmental and biomedical applications. The research area covers a broad spectrum of advanced materials, their design, synthesis, characterization, and reaction phenomena. He published more than 70 research papers and serves on the Editorial Board of "International Journal of Self-Propagating and High-Temperature Synthesis" and participated in several NSF panels in CBET division.

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