# NANOSCIENCE AND NANOTECHNOLOGY PROGRAM

**José Gerardo Cabañas-Moreno,PhD**

**Research Interests**

- Hydrogen storage (hydrides)
- Bulk nanostructured materials – processing and properties
- Materials characterization by SEM, EBSD techniques
- Nanocarbons-Polymer Composites

Dr. Cabañas-Moreno is Researcher and Coordinator of the Interdepartamental PhD Program on Nanoscience and Nanotechnology. He completed his MSc and PhD at Northwestern University, USA. He spent a sabbatical leave at Toyohashi University of Technology, Japan, as Associate Professor, working with Professor Minoru Umemoto. During 1982-2012 he worked at Instituto Politécnico Nacional (IPN) in the areas of steel processing, nanostructured materials, mechanical alloying and hydrogen storage. From 2008 to 2012 he served as the first Director of the Nanoscience and Micro-nanotechnology Center at IPN. In 2013, he accepted a position at Cinvestav, Mexico City, where he currently coordinates the interdepartamental PhD programa on Nanoscience and Nanotechnology. Dr. Cabañas-Moreno is author of more than 80 journal publications that received about 500 citations, and has been thesis advisor of 24 graduate students (M.S. and Ph.D.). He has been received numerous research grants from Mexican and international agencies. He has served in various evaluation and advisory committees for the National Council of Science and Technology

**Selected Honours and Awards**

- Member, Mexican Academy of Sciences
- Lázaro Cárdenas del Río Award for Professional Achievements from the National Polytechnic Institute
- President, Mexican Materials Society (2015-2016)

## Research Project: Nanostructured Mg alloys for hydrogen storage

My main research focus is currently the development of Mg-based materials which may be used as a safe, affordable, efficient and sustainable medium for hydrogen storage applications. The most difficult technological challenge for a widespread use of hydrogen as a means of storing energy (an "energy vector") is frequently identified with the development of adequate means of storage and transportation. The potential applications, stationary or mobile, are quite diverse, which makes highly unlikely that a single solution to hydrogen storage will be found. Instead, a number of possible storage technologies would be needed to satisfy all possible requirements.

Mg-based alloys have been shown to possess interesting properties regarding hydrogen storage capacity, affordability and sustainability. When Mg-based materials, with additions of some catalysts, are produced as nanostructured powders, the kinetics of reversible hydrogen capture (hydriding) and release (dehydriding) are considerably accelerated. However, it would be desirable to lower the operating temperatures of these materials, at least to the range of 150-200 °C. Moreover, (de)hydriding cycling usually lead to a degradation of the relevant properties of Mg-based alloys, particularly to a decrease in the storage capacity. The reasons for these unwanted changes are changes in the microstructure (grain growth) and the high reactivity of Mg with oxygen and water vapor from the atmosphere.

The investigation of ways to improve the cyclic response and the intrinsic storage properties of Mg-based materials represents the most important objective of our work.