Πρόσκληση σε Δημόσια Παρουσίαση της Διδακτορικής Διατριβής του κ. Ιωάννη Βαμβασάκη

(Σύμφωνα με το άρθρο 41 του Ν. 4485/2017)

Την **Πέμπτη 12 Μαρτίου 2020** και ώρα **11:00** στην **αίθουσα Τηλε-εκπαίδευσης,** στο κτήριο του **Τμήματος Μαθηματικών και Εφαρμοσμένων Μαθηματικών** του Πανεπιστημίου Κρήτης, θα γίνει η δημόσια παρουσίαση και υποστήριξη της Διδακτορικής Διατριβής του υποψήφιου διδάκτορα του Τμήματος Επιστήμης και Τεχνολογίας Υλικών κ. Ιωάννη Βαμβασάκη με θέμα:

«Synthesis of Mesoporous Networks of Metal-Chalcogenide Nanocrystals for Photocatalytic Applications and Hydrogen Fuel Production»

Synthesis of mesoporous (pore size from 2 to 50 nm) assembly architectures of well-defined inorganic nanocrystals (NCs) represents an important challenge in material science and chemical nanotechnology. Such self-assembled materials can incorporate complementary functionalities into the framework, such as nanoporosity and photocatalytic and quantum-confined electronic properties of individual NCs. These characteristics may endow them enhanced applications for photocatalysis, solar energy conversion, chemical sensing and size-selective adsorption and separation. Although great progress in the synthesis of nanoporous frameworks of metal and metal oxide nanoparticles with highly accessible pore surface and ordered mesoscale structure has been achieved, synthesis of assembled three-dimensional (3D) mesostructures of metal-chalcogenide NCs is still challenging.

In this dissertation, a new and cost-effective synthetic strategy for preparing mesoporous networks of interconnected metal-sulfide NCs has been successfully developed and demonstrated. By utilizing a simple polymer-templated oxidative polymerization process, the resulting self-assembled mesostructures comprise a unique combination of light-emitting metal-chalcogenide NCs and a 3D open-pore structure with large internal surface area and uniform mesopores. Through appropriate selection of the synthetic components, this assembly process provides the advantage of preparing mesoporous materials from metal chalcogenide NCs with various sizes and compositions, allowing the design and creation of tailored characteristics and desirable functionalities. Due to the large and accessible surface area and visible-light response, the present mesoporous NC-based assemblies (NCAs) were studied as potential catalysts, particularly in the challenging field of photocatalysis and photochemical water reduction for hydrogen evolution. Notably, the construction of mesoporous nanocomposite materials with different composition (e.g., CuS/CdS) or the deposition of active co-catalyst nanoparticles such as Pt and $Ni(OH)_2$ on the CdS NCAs surface synergistically improve the photoactivity of the mesostructures through the formation of efficient nano-heterojunctions; such heterojunctions can facilitate better separation and transfer of the photogenerated charges. We found that the hydrogen production activity and stability of all the examined mesoporous NCAs composites is remarkably enhanced, outperforming other reported CdS-based photocatalysts and demonstrating their potential for practical use in photocatalytic hydrogen evolution. Overall, this research work wishes to contribute to the creation of new opportunities for designing and synthesizing novel metal-chalcogenide functional nanomaterials and to a better in-depth understanding

of some key features for efficient solar-to-hydrogen energy conversion.