ΠΡΟΣ
1) Όλα τα μέλη ΔΕΠ του Τμήματος Επιστήμης και Τεχνολογίας Υλικών
2) Την Επταμελή Εξεταστική Επιτροπή
3) Όλα τα μέλη της Πανεπιστημιακής Κοινότητας

Πρόσκληση σε Δημόσια Παρουσίαση της Διδακτορικής Διατριβής της

κ. Βελεγράκη Γεωργίας

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

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θα γίνει η δημόσια παρουσίαση και υποστήριξη της Διδακτορικής Διατριβής της υποψήφιας διδάκτορος του Τμήματος Επιστήμης και Τεχνολογίας Υλικών

κ. Βελεγράκη Γεωργίας με θέμα:

«Mesoporous Assemblies from Metal and Metal Oxide Nanoparticles for Environmental Applications»

Abstract:

During the last decades, the environment is ever-charged by toxic chemicals which usually are by-product of various industrial activities and disposed uncontrollably to the environment. Such toxic chemicals not only consist a threat to the environment lifecycle but also could have devastating effects to the human being. This dissertation focuses on synthesis, structural characterization and environmental applications of ordered mesoporous networks of metal and metal-oxide nanoparticles. Specifically, it is studied the synthesis of high-surface-area mesoporous assemblies of CoO nanoparticles (denoted as CoO MNAs) and their potential application in the reductive detoxification of aqueous hexavalent chromium (Cr(VI)) solutions, under UV and visible light irradiation. The CoO MNAs materials indicate excellent photocatalytic performance which is a result of the combined effect of accessible pore volume, appropriate band edge positions and specific reactivity of the crystal phase. Moreover, in an effort to further improve the photoactivity and chemical stability of CoO assemblies, we report the synthesis of new mesoporous networks consisting of Ni and Cu-implanted cubic CoO nanoparticles (denoted as $Co_{1-x}Ni_xO$ and $Co_{1-x}Cu_xO$ MNAs) as promising photocatalysts for detoxification of Cr(VI) aqueous solutions. Mechanistic studies with X-ray photoelectron (XPS), UV–vis/near-IR optical absorption, fluorescence and electrochemical impedance (EIS) spectroscopy and theoretical (DFT) calculations indicate that the performance enhancement of these catalysts arises from the fast charge transfer kinetics, and high p-type conductivity and oxidation efficiency of surface-reaching holes.

Additional subject of the present thesis work is the fabrication of highly porous Cu nanoparticle assemblies decorated with graphite layers (denoted as Cu/G NPAs), as well as their use in surface-enhanced Raman spectroscopy (SERS) detection. The large surface area of the porous framework of Cu/G NPAs exposes essentially a number of plasmonic sites to incoming molecules, resulting in a significant SERS enhancement for chemical analyte detection. Moreover, the network structure of these materials shows a similar SERS activity across different spot areas with high reproducibility. These findings are very promising and suggest that Cu/G nanoparticle assemblies are highly efficient, cost-effective, and stable substrates for SERS detection.