PRESENTER INFORMATION

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BIOGRAPHICAL SKETCH

Alex Laikhtman is an Associate Professor in Physics in HIT – Holon Institute of Technology (Israel). He was graduated from Technion – Israel Institute of Technology in Haifa (Israel). The subject of his PhD (2003) was "Chemical and Physical Processes on Diamond Surfaces Induced by Low Energy Photon, Electron, and Ion Irradiation". Following postdocs in molecular photophysics in CNRS (Orsay, France) and space environment materials in Soreq Nuclear Research Center (Israel), in 2007 Alex joined the physics department in HIT as senior academic staff member. His main research interests are in nanoparticles characterization, functionalization, and their applications in energy related subjects like hydrogen storage and production, solar cells, sensors and more. He published more than 50 papers in peer reviewed journals and is active in a number of international research networks.

TITLE

Multilayer tungsten disulfide nanoparticles for energy related application and as breath sensors

ABSTRACT

In this webinar talk I will review our recent research on various applications of WS_2 nanoparticles. The significant parts of this work were initiated and then advanced within the STSM visits funded by the NETPORE COST action. These collaborations involved the NETPORE members in the Reykjavik University (Iceland) and Ruder Boskovic Institute in Zagreb (Croatia).

Due to porous and multilayer nature of WS_2 nanoparticles we first suggested to use them as stable and solid media for hydrogen storage using plasma assisted hydrogenation. Experimental results and DFT simulations elucidated the chemical configuration of so incorporated hydrogen as well as challenges related to the hydrogen intercalation process. However, the results of this research brought us to some further applications: namely doping of WS_2 nanoparticles to improve their semiconducting process, and increase of their surface active area by immersion to low power RF plasma. The effective doping is beneficial when using WS_2 nanoparticles as a stabilizing material and a charge transfer layer in perovskite solar cells. While surface activation dramatically improves their catalytic behavior in hydrogen evolution reaction.

Following the joint work with the Reykjavik University group we are able now to present a method for comprehensive breath monitoring utilizing a nanostructure sensor for respiratory gas analysis. The sensor consists of WS_2 nanotubes on silicon nanowires. This configuration demonstrated superior performance compared to other materials, exhibiting the shortest response time, more stable waveforms, and the least baseline drift.