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LECTURE

“Metal Oxide Nanowire Growth, Properties and Applications In Energy Conversion and Storage”

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Metal oxide nanowires (NWs) such as Sb:SnO_2 and Sn:In_2O_3 have been investigated extensively and used for the realization of novel energy conversion and storage devices such as solar cells, super capacitors etc. In the past we have shown that SnO_2 NWs grown by the vapor liquid solid mechanism have a carrier density of 10^{16} cm-3 and mobility of 70 cm^2/Vs using THz conductivity spectroscopy (1). SnO_2 is in essence a wide band gap semiconductor with an energy gap of 3.7 eV so doping is required to improve its conductivity and the performance of devices. So far Sb and Mo have been incorporated into SnO_2 NWs while recently it was shown that Pb doping results into a strain induced semiconductor to metal transition. In most cases Sb has been used for doping SnO_2 NWs. In this talk I will describe the growth mechanism and Sb dopant incorporation into SnO_2 NWs which leads to high conductivity Sb:SnO_2 NWs as determined by THz conductivity measurements. More importantly it will be shown that Sb:SnO_2 NWs may be grown a variety of substrates such as Si, Al_2O_3 as well as flexible C fiber networks and metal foils which is important for the realization of energy conversion and storage devices such as solar cells and super capacitors. The realization of such highly conductive Sb:SnO_2 NWs is also important in replacing Sn:In_2O_3 NWs which contain In that is rare and expensive (2,3).

(1) D.Tsokkou, A.Othonos and M.Zervos,' THz conductivity spectroscopy of SnO2 nanowires', Applied Physics Letters, **100**, p.133101(2012).
(2) M.Zervos, C.Mihailescu, J.Giapintzakis, P.Komninou, N.Florini and J.Kioseoglou ‘Broad compositional tunability of indium tin oxide nanowires grown by the vapor liquid solid mechanism’, *Applied Physics Letters Materials*, **2**, p.056104 (2014).
(3) M.Zervos, E.Leontidis, E.Tanasu, Eu.Vasille and A.Othonos, Sn:In_2O_3 and Sn:In_2O_3/NiS_2 core-shell nanowires on Ni, Mo metal foils and C fibers for H_2 and O_2 generation', J. Phys. Chem. C, 2017, 121 (50), pp 27839–27848