Point Defects in Functional Nano-Materials and Their Role in Energy Storage Devices

Emre Erdem[1]

[1] Sabanci University, Faculty of Engineering and Natural Science, Materials Science and Nano Engineering Department, Orhanli - Tuzla, Istanbul, Turkey.

emre.erdem@sabanciuniv.edu

Electron paramagnetic resonance (EPR) is a very powerful method due to its enhanced sensitivity to unpaired electrons. In order to understand the defect structure in functional nano-materials we use multi-frequency EPR spectroscopy. In this presentation i) quantum confinement effects in ferroelectric nano-materials ii) EPR and Photoluminescence (PL) investigations of intrinsic defect centers in semiconductor zinc oxide (ZnO) nanoparticles will be given iii) application of metal oxides as electrodes in supercapacitors will be discussed. Starting with the introductory information about EPR spectroscopy; poling, aging, doping and nano-size effects will be discussed for the ferroelectric materials such as, $PbTiO_3$, $BaTiO_3$, $PbZrTiO_3$ (PZT) etc. In the second part of the talk, surface and core defects and their reactivity under temperature and light will be presented for ZnO semiconductor nano-materials. Defect models will be discussed. Finally, in the last part designs of supercapacitor devices will be given and the role of defect structures in the electrochemical performance of supercapacitor devices will be presented.

Figures

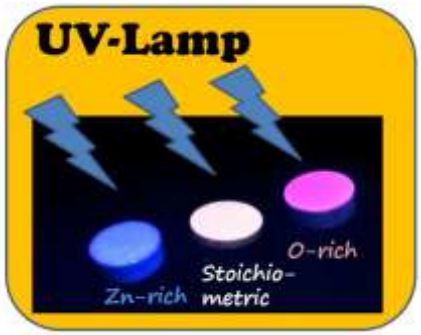

Figure 1. Defect evolution of non-stoichiometric ZnO.