The optical emission spectroscopy of the inductively coupled plasma used for modification of chemical, optical and electronic properties of nanostructured ZnO

Zdeněk Remeš[1], Júlia Mičová[2], Bohuslav Rezek[3], and Hua-Shu Hsu[4]

[1]*Institute of Physics of the Czech Academy of Sciences, Na Slovance 1999/2, Praha 8, Czech Republic*
[2]*Institute of Chemistry SAS, Dubravska cesta 9, 84538 Bratislava, Slovakia*
[3]*CTU Faculty of Electrical Engineering, Technická 2, 166 27 Praha 6, Czech Republic*
[4]*National Pingtung University, Minsheng Rd. 4-18, 900 Pingtung City, Taiwan*

Plasma treatment of the nanostructured surface of thin films has increasingly attracted the attention of scientists and technologists due to the high surface-to-volume ratio and related size effects. The surface and size effects impose challenges for energy conversion or sensing applications, i.e., in solar cells, optoelectronic devices, gas sensors, or electrochemical energy storage. The plasma modification of surfaces by plasma processing provides further adjustment of properties for application. The plasma treatment is done in a novel inductively coupled plasma (ICP) reactor and monitored in-situ by optical emission spectroscopy (OES) in the spectral range 350-1050 nm. The reactor operates at 13.56 MHz, 10-200 W discharge power, pressure 1-100 Pa and gas flow 1-100 sccm using hydrogen (purity 99.999%), oxygen (purity 99.995%), argon (purity 99.998%) and nitrogen (purity 99.999%). After the plasma treatment of single crystal as well as nanostructured ZnO [1] we observe changes in the chemical, optical and electronic properties such as optical absorption spectra, photoluminescence spectra, Raman spectra, surface conductivity, surface energy as measured by contact angle.

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