**Ivan Franko National University of Lviv, Lviv, Ukraine**
**Jan Długosz University, Częstochowa, Poland**
**Scientific Research Company "Carat", Lviv, Ukraine**

# *ISPCS'10*

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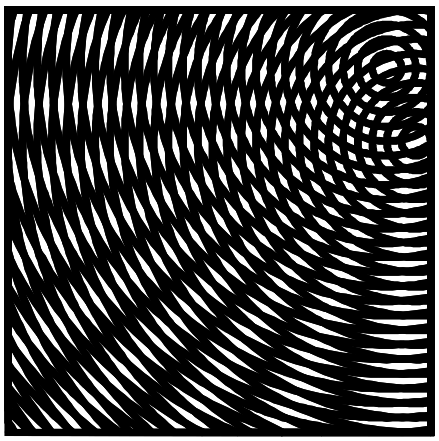

# Seminar Program
# &
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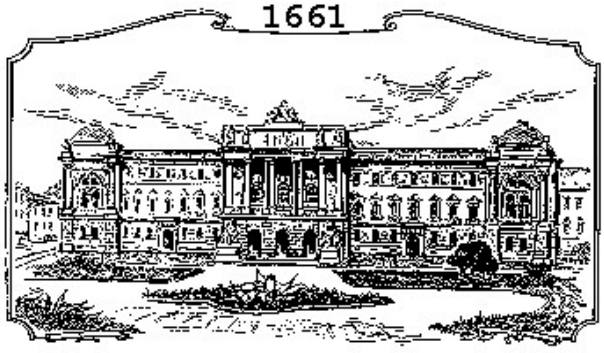


**June 6-9, 2010**
**Lviv, Ukraine**

# STRUCTURAL, SUPERFICIAL AND OPTICAL PROPERTIES OF NANOSTRUCTURED POLYCRYSTALLINE ZnO:X (Cu, Ag) FILMS

B. Kulyk[1], V. Figà[2], V. Kapustianyk[1], M. Panasyuk[1], R. Serkiz[1], P. Demchenko[3]

[1]Scientific-Technical and Educational Center of Low Temperature Studies, Scientific and Educational Center "FRACTAL", Department of Physics, Ivan Franko National University of Lviv, Dragomanova Street, 50, UA-79005 Lviv, Ukraine
[2]Department of Chemical, Process and Materials Engineering, University of Palermo, Viale delle Scienze, 90128 Palermo, Italy
[3]Department of Chemistry, Ivan Franko National University of Lviv, Kyryla i Mefodiya Street, 6, UA-79005 Lviv, Ukraine

ZnO is a wide-band gap oxide semiconductor with a direct energy gap of about 3.37 eV and high exciton binding energy of 60 meV. In the last years, ZnO has emerged as one of the most promising materials due to its optical and electrical properties, high mechanical and chemical stability, together with its abundance in nature and non-toxicity. As it is known, the metals of group I (Ag, Cu) are fast-diffusing impurities in the semiconductor compound. The diffusion of copper or silver into ZnO can cause changes in the characteristics of its structure and, therefore, in the other physical properties.

The XRD analysis of copper- and silver-doped ZnO films confirms their hexagonal wurtzite structure with the preferred orientation (002) in the direction perpendicular to substrate plane. With the Cu or Ag dopant amount increasing in the XRD spectra the shift of (002)-peak into direction of higher values of $2\theta$ takes place due to isomorphous substitution of $Zn^{2+}$ by $Ag^{+}$ or $Cu^{2+}$ ions. AFM micrograph analysis indicates the granular character of ZnO:X (Cu, Ag) films. The average grain size and the surface roughness are related to the amount of Cu or Ag dopants i. e. they decrease with concentration of Cu and increase with concentration of Ag. Evidently, the difference in ionic radius of dopant in comparison with $Zn^{2+}$ ion promotes better ZnO grain growth during deposition.

The temperature variation of optical absorption edge of Cu- and Ag-doped ZnO films was described by a modified Urbach's rule [1] according to which the slope of energy dependences of logarithm of the absorption coefficient in contrast to bulk materials does not change with temperature increasing and parallel shift of these dependences into direction of lower energy takes place. The effective frequencies of phonons taking part in formation of the absorption edge were calculated and the temperature behavior of band-gap energy was examined in studied polycrystalline films.

[1] B. Turko, V. Kapustianyk, V. Rudyk, G. Lubochkova, B. Simkiv, J. Appl. Spectrosc. 73 (2006) 222–226.