199 Band gap engineering of chemically deposited CdS:Al thin films in an ammonia-free system

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Aluminium doped and undoped CdS thin films were deposited on glass substrates by chemical bath deposition technique in an ammonia-free cadmium-sodium citrate system. The purpose if this work is to enlarge the band gap of CdS, by means of Al doping. We want to use this films as optical windows of thin film solar cells, enhancing the blue response of the photovoltaic device enlarging the band gap of CdS [1,2].

We determine the structural and optical properties of the CdS:Al thin films, by using X-ray diffraction (XRD), scanning electron microscope (SEM), optical transmission (OT) and photoacoustic spectroscopy (PAS) measurements. We found that the characteristics of the films depends on Al/Cd mole ratio in solution and the deposition time. Film thickness obtained are between 145 nm and 256 nm. The increasing of Al in the reaction solution yields to a thicker CdS films with smaller crystallite size and higher energy band gap, as we show in Fig. 1. We show that nanometric size of the crystallite (from 40 nm to 16 nm) is a key parameter to modify the optical properties of CdS, because of its relation with film microstresses and thickness. We do not found quantum confinement effects due to crystallite sizes are bigger than 10 nm [3].

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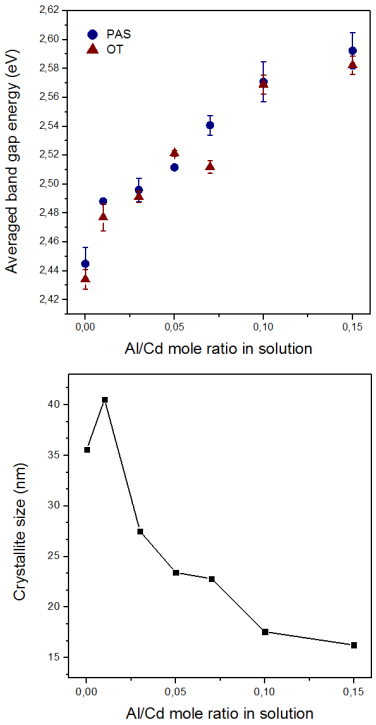

Fig. 1 *Up: Average band gap obtained with OT and PAS for CdS:Al thin films grown with different Al/Cd mole ratio in solution. Down: CdS:Al crystallite sizes obtained with XRD for different Al/Cd mole ratio.*

References

[1] M. G. Sandoval-Paz, M. Sotelo-Lerma, A. Mendoza-Galvan, R. Ramrez-Bon, Thin Solid Films **515**, 3356-3362 (2007).

[2] M. A. Contreras, M. J. Romero, B. To, F. Hasoon, R. Noufi, S. Ward, K. Ramanathan, Thin Solid Films **403-404** 204-211 (2002).

[3] A. Cortés, H. Gómez, R. E. Marotti, G. Riveros, E. A. Dalchiele, Sol. Energy Mater. Sol. Cells **82** 2134 (2004).