Study of microstructure and optical properties of PVA-Capped ZnS: Cu nanocrystalline thin films

Thi T.M., Van B.H., Ben P.V.

Faculty of Physics, Hanoi National University of Education, 136 Xuan Thuy, Cau Giay District, Hanoi, Viet Nam; Faculty of Physics, College of Science, Hanoi National University, 334 Nguyen Trai, Hanoi, Viet Nam

Abstract: A study has been carried out on the Cu doping and PVA capping induced optical property changes in ZnS : Cu nanocrystalline powders and thin film. For this study, ZnS : Cu nanopowders with Cu concentrations of 0.1%, 0.15%, 0.2%, 0.3% and 0.4% are synthesized by the wet chemical method. The polyvinyl alcohol (PVA)-capped ZnS thin film with 0.2% Cu concentration and various PVA concentrations are prepared by the spin-coating method. The microstructures of the samples are investigated by the X-ray diffraction (XRD) patterns and transmission electron microscopy (TEM). The results show that the prepared samples belong to the wurtzite structure with the average particle size of about 3-7 nm. The optical properties of samples are studied by measuring absorption and photoluminescence (PL) spectra in the wavelength range from 300 nm to 900 nm at 300 K. It is shown that the luminescent intensity of ZnS : Cu nanopowders reaches the highest intensity for optimal Cu concentration of 0.2% with the corresponding values of its direct band gap estimated to be about 3.90 eV. While the PVA coating does not affect the microstructure of ZnS nanometerials, the PL spectra of the samples are found to be affected by the PVA concentration as well as the exciting power density. The influence of the polymer coating on the optical properties can be explained by the quantum confinement effect of ZnS nanoparticles in the PVA matrix.

Author Keywords: absorption spectra; photoluminescence spectra; PVA-capped ZnS : Cu nanocrystalline thin film

Year: 2010
Source title: Journal of Nonlinear Optical Physics and Materials
Volume: 19
Issue: 2
Page : 237-245
Link: Scorpus Link
Correspondence Address: Thi, T. M.; Faculty of Physics, Hanoi National University of Education, 136 Xuan Thuy, Cau Giay District, Hanoi, Viet Nam; email: tranminhthi@hnue.edu.vn
ISSN: 2188635
DOI: 10.1142/S021886351000525X
Language of Original Document: English
Abbreviated Source Title: Journal of Nonlinear Optical Physics and Materials
Document Type: Article
Source: Scopus

Authors with affiliations:

- Thi, T.M., Faculty of Physics, Hanoi National University of Education, 136 Xuan Thuy, Cau Giay District, Hanoi, Viet Nam
- Van, B.H., Faculty of Physics, College of Science, Hanoi National University, 334 Nguyen Trai, Hanoi, Viet Nam
- Ben, P.V., Faculty of Physics, College of Science, Hanoi National University, 334 Nguyen Trai, Hanoi, Viet Nam

References:

- Ghosh, P.K., Jana, S., Nandy, S., Chattopadhyay, K.K., (2007) Materials Research Bulletin, 42, pp. 505-514
- Bol, A.A., Ferwerda, J., Bergweff, J.A., Meijerink, A., (2000) J. Luminescence, 99, pp. 325-334
- Ishizumi, A., White, C.W., Kanemitsu, Y., (2004) Appl. Phys. Lett., 84, pp. 2397-2399
- Wang, M., Sun, K., Fu, X., Yan, C.L.C., (2000) Solid State Comm, 115, pp. 492-496
- Lee, S., Song, D., Kim, D., Lee, J., Kim, S., Park, I.Y., Choi, Y.D., (2004) Materials Lett, 58 (3-4), pp. 342-346
- Maity, R., Maiti, U.N., Mitra, M.K., Chattopadhyay, K.K., (2006) Chattopadhyay, Physica e, 33, pp. 104-109
- Jayanthi, K., Chawla, S., Chander, H., Haranath, D., (2007) Cryst. Res. Technol., 42 (10), pp. 976-982
- Yang, P., Lu, M., Xu, D., Yuan, D., Zhou, G., (2001) Chem. Phy. Lett., 336, pp. 76-80
- Oztas, M., Bedin, M., Yazici, A.N., Kafadar, E.V., Toktamis, H., (2006) Physica B, 381, pp. 40-46
- Chen, W., Joly, A.G., Malm, J.-O., Bovin, J.-O., (2004) J. Appl. Phys., 95 (2), pp. 667-672