

# 8<sup>th</sup> INTERNATIONAL CONFERENCE ON MATERIALS SCIENCE AND CONDENSED MATTER PHYSICS

dedicated to

the 70<sup>th</sup> anniversary of the foundation of first research institutions of the ASM,  
the 55<sup>th</sup> anniversary of the inauguration of the Academy of Sciences of Moldova,  
the 70<sup>th</sup> anniversary of Moldova State University  
the 90<sup>th</sup> anniversary of academician Sergiu Radautsan

## ABSTRACTS

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SSNN 20P ATMOSPHERIC CORROSION IN AGED BULK AND FIBER AMORPHOUS  
 $\text{As}_2\text{S}_3$  WITH PHOTSENSITIVE REALGAR INCLUSIONS

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We have studied the light emission properties of aged amorphous bulk and fiber  $\text{As}_2\text{S}_3$  and freshly fractured a- $\text{As}_2\text{S}_3$  with photosensitive realgar inclusions in the 1.5–4.5 eV spectral range and applying different excitation photon energies. Additionally, Raman scattering measurements were performed on bulk and fiber a- $\text{As}_4\text{S}_6\text{O}$  to investigate structural changes caused by corrosion of the glass in air. Major features in the luminescence spectra were observed at 1.72, 1.86, 2.02, 2.26, 2.80 and 3.24 eV photon energies. The 1.72 eV band in PL of g- $\text{As}_2\text{S}_3$  was identified to be related to the As side by comparison of the PL spectrum with literature data for  $\text{As}_4\text{S}_4$  realgar crystal. A newly observed band at 1.86 eV was assigned to the As side in pararealgar occurring due to the light induced transformation from realgar to pararealgar phase. An oxidation process was found to take place during the aging and photo-aging accompanied with formation of As oxides, indicated by the emission bands at 2.02 and 2.26 eV. A rapid photo-oxidation process was observed in freshly fractured surfaces at room temperature which was connected with the light stimulated realgar-pararealgar transformation.

It was established that during the aging process the temperature variations lead to the condensation of the moisture and active dissolution of the oxide phases at the surfaces of bulk and fiber a- $\text{As}_2\text{S}_3$ . The dominant emission band around 2.8 eV, appearing in the PL spectra of a- $\text{As}_2\text{S}_3$  excited by different photon energies may be assigned to the  $\text{As}_2\text{O}_3 \cdot n\text{H}_2\text{O}$  solution. Characteristic features of  $\text{As}(\text{OH})_3$  were observed in Raman spectrum of g- $\text{As}_2\text{S}_3$  excited with near band gap energies.

The analysis of the PL spectra of freshly fractured a- $\text{As}_2\text{S}_3$  surfaces with realgar nanophase inclusion demonstrated that the photoaging on air is caused by the realgar to pararealgar transformation [1] and mass-transport [2] is accompanied by simultaneous formation oxide phases. The appearance of a PL band typical for  $\text{As}_2\text{O}_3 \cdot n\text{H}_2\text{O}$  was observed during UV excitation of the freshly fractured a- $\text{As}_2\text{S}_3$  surfaces. Intensities of PL bands from freshly fractured surfaces are at least 10 times lower compared to those measured on aged on air surfaces.

[1] R. Holomb, N. Mateleshko, V. Mitsa, P. Johansson, A. Matic, M. Veres. *J. Non-Cryst. Sol.* **352** (2006)1607-1611.

[2] O. Kondrat, R. Holomb, N. Popovich, V. Mitsa, M. Veres, A. Csik, A. Feher, N. Tsud, M Vondráček, V. Matolín, K.C. Prince. *Journal of Applied Physics.* **118**(2015)225307(7)