### Nanoscale investigation of microstructure effects on hydrogen behaviour in rapidly solidified aluminium alloys

**I. Tashlykova-Bushkevich**
*Belarusian State University of Informatics and Radioelectronics, Belarus*

A key breakthrough in hydrogen embrittlement (HE) studies in Al-based systems is considered to be nanoscale and sub-micrometer characterization of their local composition and structure accompanying H measurements. While embrittlement mechanisms remain controversial regarding Al alloys of commercial interest as liner materials for efficient storage of compressed hydrogen gas, it should be highlighted that a lack of information on H behaviour in rapidly solidified (RS) Al materials prepared at exceptionally high cooling rates provides a renewed stimulus to developing a deeper mechanistic understanding of H/microstructure interactions in high strength Al alloys aimed to control the problem of HE in Al materials. This work presents an overview of our recent results on diffusion and trapping of hydrogen with emphasis on nano-scale microstructural evolution in RS Al-based alloys. Application of ion beam analysis techniques provided direct observations of elemental composition and microstructure with nanoscale precision (20-40 nm depth resolution) within the near-surface regions in the RS alloys. Thermal desorption spectroscopy was employed to analyse H trap states in the specimens. It was found out that H behaviour in RS Al binary alloys (with V, Cr, Fe, etc.) is strongly affected by alloying elements trapping at vacancies in respect to observed nonuniform dope distribution below the foil surface (up to 2.0 μm depth). Based on obtained patterns of H evolution as well as revealed enrichment/impoverishment behaviour of solutes at thin surface layers in foils it can be concluded that the role of lattice defects on solute/microstructure interactions represents key contribution to the understanding of H trapping in RS Al alloys.

**NOTES**

## Session «Electromagnetic shielding II (ISTC Workshop)»

### Glasses with PbS and PbSe nanoparticles as saturable absorbers for mode-locked solid state lasers

**V. Gurin, G. Rachkovskaya, G. Zakharevich, K. Yumashev, P. Loiko**
*Research Institute for Physical Chemical Problems of Belarusian State University, Belarus;*
*Belarusian State Technological University, Belarus;*
*Scientific Research Centre of Optical Materials and Technologies of Belarusian National Technical University, Belarus*

Non-linear optical devices can be designed on the basis of various nanostructures. Semiconductor nanoparticles (quantum dots) within dielectric matrices are of interest due to their strong interaction with light (absorption, scattering, luminescence, etc.) and opportunity to control both linear and non-linear optical features through chemical composition and size of nanoparticles and stabilization in solid matrices. An intense light generates electrons and holes (and excitons) providing transient states of quantum dots, thus influencing the light absorption. In the present work, we consider fabrication of glasses doped with lead chalcogenide quantum dots and their application for construction of saturable absorbers for mode-locking and Q-switching devices in the near IR-range. The glasses were prepared using an original technique on the basis of silicate glass-forming system doped with lead compounds and chalcogenes. The melting of all components was done in the reducing environment followed by cooling and secondary heat treatment at 450-600oC in air. PbS and PbSe nanoparticles of the size range of 5-50 nm were formed within the transparent glass providing optical response of materials. They were characterized by XRD, SAXS, TEM and optical spectroscopy. An explicit correlation between particle size and exciton energies was established evidencing the quantum confinement effect. The glasses can successfully function within IR lasers as efficient mode-locking elements.

**NOTES**