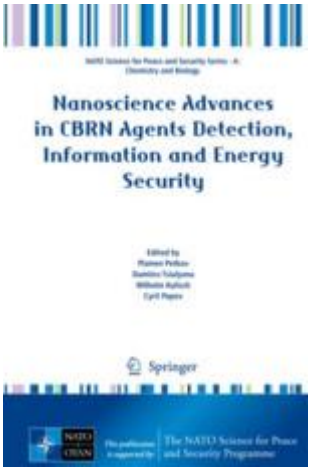

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Effect of the Ge Concentration on the Photoformation of Solid Electrolytes in Ag/As-S-Ge Thin Films

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Abstract

Solid electrolytes in the system Ag/As-S-Ge have been fabricated by Ag photodissolution into glassy thin As-S-Ge films of various composition. To realize the transition from a trigonal to a tetragonal structure of the network, the concentration of Ge was increased monotonically, along with a decreased As concentration. The process of Ag photodissolution into the films, followed by the formation of solid electrolytes was controlled by monitoring the changes that occur in the optical transmission of broadband light which is only weakly absorbed in Ag/As-S-Ge. The probing wavelength was λ>0.65 μm (hν<1,9 eV), the range in which the chalcogenide glasses (ChG) used are entirely transparent. It was shown that the kinetics profiles comprise of two consecutive linear steps, but the transition between these steps is not monotonic. The photodissolution rate and the amount of Ag incorporated in the first step were found (except of GeS4) not to depend on the glass composition. This result provides evidence for a preferential and direct interaction of Ag with free sulfur at the interface. The rate of photodissolution

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in the second linear step exhibits a maximum for compounds with approximately 8 at.% Ge, being by two orders of magnitude higher than the rate for GeS_4. This maximum was qualitatively attributed to the fact that only a few, very specific Ag-photodoped glass compositions yield a homogeneous material.