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# Modification of spin-coated thin chalcogenide films composition by source solution doping

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## Abstract

Chalcogenide glasses are promising materials for fabrication of optical (micro)elements due to high values of refractive index and wide transmission window in IR. Chalcogenide glasses are frequently used in a thin film form, most commonly deposited by vacuum thermal evaporation, but other techniques based on their solubility in volatile organic bases are recently gaining attention (e.g. spin-coating, spiral-bar coating, etc.). Main advantage of solution based thin films lies in the simplicity and thus low cost of used deposition techniques. Research in this field is mostly focused on glasses of As-S system. Nevertheless, thin films of non-toxic glass compositions (e.g. Ge-S, Ge-Sb-S systems) have been successfully deposited in optical quality using these techniques as well.

The standard procedure of the thin film preparation via solution way requires synthesis of the source bulk glass of the desired composition by standard melt-quenching method, dissolving in organic amine followed by deposition by chosen technique. The composition of prepared thin films corresponds to the composition of the source bulk glass.

In presented work we demonstrate the possibility to modify the thin film composition by changing the composition of source glass solution. Glass solution was prepared using As<sub>40</sub>S<sub>60</sub> bulk glass and the 5N sulfur targeting As<sub>30</sub>S<sub>70</sub> composition. Thin films in specular optical quality were obtained using spin-coating method. Optical properties, thickness, chemical resistance, structure and elemental composition of the thin films were studied in dependence on the annealing temperature. Results were compared with properties of thin films of the same As<sub>30</sub>S<sub>70</sub> composition prepared by standard procedure from As<sub>30</sub>S<sub>70</sub> bulk glass. Different thermo-induced structural transformations were observed in both sets of samples resulting in As<sub>30</sub>S<sub>70</sub> thin films of very similar properties. The possibility to alter the thin film composition by modifying the composition of the glass solution significantly simplifies the tailoring of the materials properties.

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