Kinetics Peculiarities Describing *in-situ* Photodarkening in Thin As-Se Films

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Amorphous chalcogenides like binary arsenoselenides are known to be unique disordered materials possessing extremely high sensitivity to external factors. As an example, the photo-induced optical effects typically revealed themselves in photodarkening (e.g. long-wave shift of fundamental optical absorption edge), have been put in a ground for chalcogenide-based sensors, optical memory and switching devices, information storage systems, etc. These photoinduced effects clearly demonstrate two principally different components in chalcogenide films, the transient changes occurring under *in-situ* photoexposure and metastable or permanent ones leaving for a long time in the illuminated films after photoexposure stopping (*ex-situ* photodarkening)

In this work the realistic governed kinetics *in-situ* photodarkening in amorphous arsenoselenide films of different thicknesses (from 0.54 to 4.07 μm), pre-history (virgin and annealed) and chemical composition ($As_{40}Se_{60}$, $As_{50}Se_{50}$ and $As_{60}Se_{40}$) pumping with the same light beam having different penetration depth in each sample were studied.

$As_{100-x}Se_x$ films of different thicknesses (d=0.54÷4.07 μm) were prepared by flash thermal evaporation in a vacuum onto glass substrates held at 100 °C. One part of films was additionally annealed at T=120 °C during 1 hour to produce small darkening in respect to un-annealed films.

To initiate photostructural transformation in the studied films, a He-Ne laser (λ=633 nm, W=10 mW) operated in CW irradiation mode was used. Experimental set-up allowed simultaneous photodarkening activation and *in-situ* optical transmission measurements at the same wavelength of λ=633 nm.

It was shown the *in-situ* photodarkening in amorphous arsenoselenide As-Se films is non-dispersive in nature, its kinetics description on thickness, thermal pre-history and chemical composition being governed by penetration depth parameter (the inverse value of the absorption coefficient) of pumping light beam in respect to film thickness: the greater penetration depth of pumping light, the smaller non-dispersivity in the resulting photodarkening kinetics. In contrast, if film thickness is less than penetration depth, the stretched exponential relaxation kinetics tents towards simple exponential one.