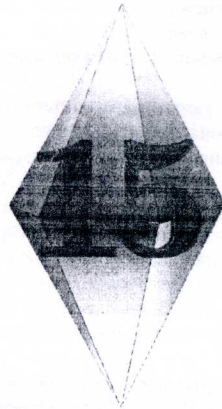


**PHYSICS AND TECHNOLOGY
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Kinetics Peculiarities Describing *in-situ* Photodarkening in Thin As-Se Films

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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 ($\text{As}_{40}\text{Se}_{60}$, $\text{As}_{50}\text{Se}_{50}$ and $\text{As}_{60}\text{Se}_{40}$) pumping with the same light beam having different penetration depth in each sample were studied.

$\text{As}_{100-x}\text{Se}_x$ films of different thicknesses ($d=0.54\div 4.07 \mu\text{m}$) were prepared by flash thermal evaporation in a vacuum onto glass substrates held at 100 °C. One part of films was additionally annealed at $T=120 \text{ }^\circ\text{C}$ 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 ($\lambda=633 \text{ nm}$, $W=10 \text{ mW}$) 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 $\lambda=633 \text{ nm}$.

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.