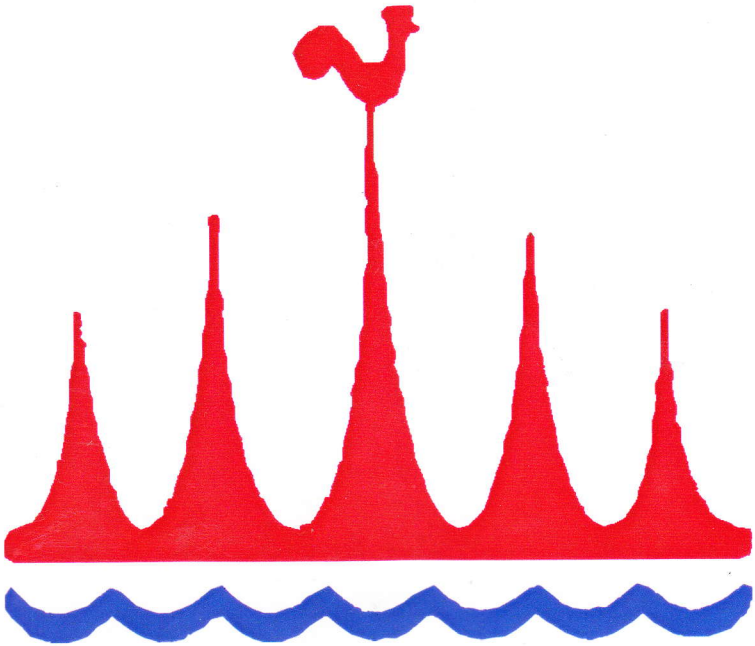

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# RECORDING AND SELF-ENHANCEMENT OF DYNAMIC POLARIZATION GRATINGS IN DEGENERATE FOUR-WAVE- MIXING GEOMETRY

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Degenerate four-wave- mixing (DFWM) is an unusual method of holographic grating (HG) recording which enable real-time phase conjugation of light beams. Mainly scalar DFWM has been studied [1]. In this paper, scalar and vectorial DFWM in a-$As_2S_3$ chalcogenide and in azobenzene molecular **K-RJ-4-3** [N,N-bis(5,5,5-tryphenylpentyl)-4-((4-tritylphenyl) diazenyl)aniline] glassy films are experimentally investigated. Coherent self-enhancement (CSE) of HG in this geometry was studied as well, for the first time to our knowledge.

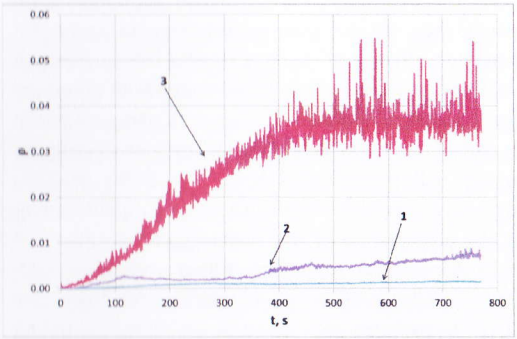


***Fig.1***. Exposure time dependences of DFWM efficiency, $\rho$ in the case of **K-RJ-4-3** film for different recor-ding beam polarizations: 1- linear *s-s*,2 – circular R-R, 3- linear *p-p*.
Recording and readout wavelength was 532 nm, HG period was 2 μm, recording light intensity was 0.90 W/cm$^2$. Note that DFWM efficiency values up to 4% have been achieved.
In the case of L-R circular polarizations $\rho$=14.5% was measured in the same sample.

Scalar linear *s-s*, *p-p* and circular R-R(right) polarizations and orthogonal linear *s-p* and circular L(left)-R polarizations were used for HG recording with 2 μm period at 532 nm. Recording light intensity was 0.90 W/cm$^2$, the recording beam power ratio was $P_2/P_1$= 3 (optimal for the achievement of maximum DFWM efficiency [1]). DFWM efficiency was defined as $\rho=P_{inv}/P_1$ , $P_{inv}$ being the inverted beam power. DFWM efficiency time dependences were measured.

Strong but different polarization dependences in both films were found. In the case of **K-RJ-4-3** film L-R polarizations were the most efficient enabling $\rho_{max}$=14.5% and specific recording energy $H_{max}$=74.5 J/(cm$^2$%). In the case of a-$As_2S_3$ film *s-s* polarizations were the best- $\rho_{max}$=6.0% and $H_{max}$= 3.0 J/(cm$^2$%) thus surpassing the corresponding parameters for a-$As_{40}S_{15}Se_{45}$ film [1].

CSE of HG in DFWM geometry (readout with $P_2$ beam) has exhibited a different polarization dependence compared to normal DWFM recording. CSE factor $\rho/\rho_0$ ($\rho_0$ being the initial $\rho$) was measured as a function of time. It was the highest for **K-RJ-4-3** film (6.8) with *s-s* polarizations compared with 3 for a-$As_2S_3$ film with *p-p* polarizations. CSE can be also regarded as a different kind of DFWM method. Then recording energy is lower for **K-RJ-4-3** film and higher for a-$As_2S_3$ film in comparison with normal DFWM recording.

DFWM method has two advantages when compared to normal HG recording: 1) a signal beam shutter is not necessary; 2) a higher signal-to-noise ratio at the photodetector site.

## References

[1] A.Ozols, K.Ozols, G.Ivanovs, Phase conjugation properties of a-As-S-Se films, Proc. of SPIE, vol. 6180, pages 61801-1 – 61801-6 (2006).