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Self-phase modulation in azo-dye-doped liquid crystals HUI-CHI LIN, CHIA-WEI CHU, Department of Physics, National Cheng Kung University, Tainan, Taiwan 701, Taiwan, MING-SHIAN LI, Institute of Electro-Optical Science, National Cheng Kung University, Tainan, Taiwan, 701, Taiwan, ANDY YING-GUEY FUH, Department of Physics, and Advanced Optoelectronic Technology Center, National Cheng Kung University, Tainan, Taiwan 701, Taiwan — We investigate the photo-induced reorientation in azo-dye doped liquid crystal (ADDLC) films by observing the diffraction patterns due to self-phase modulation. The experimental results show that the change of refraction index (Δn) of the ADDLC sample increases with the intensity of green light (I_G) to a maximum $\Delta n = 0.09$ at $I_G = 0.7$ W/cm^2 , then decreases to zero at $I_G = 1.1$ W/cm^2 , and increases again with I_G to a saturated $\Delta n = 0.0376$ at $I_G = 1.8$ W/cm^2 . The mechanism is mainly due to the competition between the negative and positive torques resulted from trans \rightarrow cis and cis \rightarrow trans isomerizations of azo dyes, respectively. The reorientation effect in the ADDLC sample illuminated by the biphotonic lasers (green and red lasers) is also studied by observing the self-phase modulation diffraction pattern. The experimental results indicate that the biphotonic lasers can be used to modulate the change of refractive index of the sample. The reason is due to the fact that the red light can enhance the positive torque resulted from cis \rightarrow trans isomerization, and then change the direction of reorientation of LCs.

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