Abstract of Presentation

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Presentation Title(Should be no more than 20 words):
Surface relief grating and retardagraphy: Optical manipulation of azobenzene polymer films and its applications

Abstract :

Novel optical recording techniques, using azobenzene polymer films, are presented. The recording of polarization holographic gratings using azobenzene-containing polymer films as photoanisotropic materials has been reported. This photoinduced anisotropic effect is due to trans-cis-trans isomerization and the orientational effects of the azo-dye chromophore. A surface relief structure is recorded through photoisomerization and the movements of the polymer chains. This is a one-step fabrication technique. A surface relief structure is fabricated by irradiation of interference laser fringes onto azobenzene functionalized polymers such as side-chain-type and main-chain-type azo-polymers. This structure is very stable at temperatures below the glass transition temperature T_g and can be erased by heating above T_g. This fabrication mechanism is not well understood at present, but several models have been proposed. We have recently reported that the diffraction efficiency of the surface relief structure can be markedly increased by corona charging. Moreover, such a hologram exhibits nonlinearity, because the orientation of the azo chromophore and the increase in the diffraction efficiency are performed concurrently by corona charging.

By using trans-cis-trans isomerization and the orientational effects of the azo-dye chromophore, polarization patterns can be directly recoded on azobenzene polymer films. This technique is called retardagrapy. In retardagraphy, the retardance pattern of an optical anisotropic object is recorded on a polarization-sensitive medium. Then, the medium has an optical anisotropy corresponding to the retardance pattern of the original anisotropic object. The absolute values of the recorded information (retardance pattern) can be reconstructed using an ellipsometric analysis, whereas it is difficult to record and reconstruct the absolute values of the retardance pattern using other techniques like polarization holography or conventional holography. Retardagraphy is expected to be applicable to pattern matching between optical anisotropic objects. Furthermore, retardagraphy can be applied for optical data storage using a single laser beam when a variable optical anisotropic object such as a liquid crystal spatial light modulator (SLM) is used as the recording information.