Nanocomposites and nanomaterials

E-beam image recording in $Ge_5As_{37}S_{58}$–Se nanomultilayer structures

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Thin films based on chalcogenide glasses have rapidly evolved as light sensitive materials for high density recording media application due to their optical and structural properties. Light-sensitivity effect of thin chalcogenide films was discovered fifty years ago [1] and perhaps photo-stimulated or stimulated by electron beams, X-rays changes of their properties are the most interesting phenomena exhibited by these materials. In this work the experimental results showing the surface relief formation in $Ge_5As_{37}S_{58}$-Se nanomultilayer structures under e-beam exposure are presented.

Amorphous $Ge_5As_{37}S_{58}$–Se nanomultilayers were prepared by computer driven cyclic thermal vacuum deposition from two isolated boats with $Ge_5As_{37}S_{58}$ and Se on constantly rotated glass substrate with deposited ITO layer at room temperature in one vacuum deposition cycle. The control of the thickness was carried out in-situ during the thermal evaporation by interference thickness sensor at $\lambda = 0.95\mu m$. Overlapping part of samples contains alternating nanolayers of $Ge_5As_{37}S_{58}$ with thickness of 1020 nm and Se with thickness of 1980 nm. The total number of nanolayers was 200. Control layers of $Ge_5As_{37}S_{58}$ and Se compositions were deposited at the same time onto the same substrate consequently through masks and used to check the composition and calculate the ratio of the sub-layer thicknesses in one modulation period. The Ukrainian and Moldavian state emblems were chosen with size 512×512 pixels as initial image figures and were recorded by e-beam exposure using scanning-electron microscope Tesla BS 300 with programmable exposure control unit. The accelerating voltage was 25 kV and the size of the electron spot at this voltage was about 300 nm. Morphology and surface relief of the obtained images were studied by AFM microscopy. From obtained data one can see that distance between pixels consists 3 μm. Size of pixels is about 1 μm and profile depth ~300 nm.

1. M. T. Kostishin, E. V. Mikhailovskaya, P. F. Romanenko, G. A. Sandul, Journ. of Applied and Scientific Photography and Cinematography, **10** (6), (1965) 450.

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