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Laser Writing on Vitroceramic Disks for Petabyte Data Storage

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Abstract : The continuous need of more non-volatile memories with a higher storage capacity, smaller dimensions and weight, as well as lower costs, has led to the exploration of optical lithography on active media, as well as patterned magnetic composites. In this context, optical lithography is a technique that can provide a significant decrease of the information bit size to the nanometric scale. However, there are some restrictions that arise from the need of breaking the optical diffraction limit. Major achievements have been obtained by employing a vitoceramic material as active medium and a laser beam operated at low power for the direct writing procedure. Thus, optical discs with ultra-high density were fabricated by a conventional melt-quenching method starting from analytical purity reagents. They were subsequently used for 3D recording based on their photosensitive features. Naturally, the next step consists in the elucidation of the composition and structure of the active centers, in correlation with the use of silver and rare-earth compounds for the synthesis of the optical supports. This has been accomplished by modern characterization methods, namely transmission electron microscopy coupled with selected area electron diffraction, scanning transmission electron microscopy and electron energy loss spectroscopy. The influence of laser diode parameters, silver concentration and fluorescent compounds formation on the writing process and final material properties was investigated. The results indicate performances in terms of capacity with two order of magnitude higher than other reported information storage systems. Moreover, the fluorescent photosensitive vitroceramics may be integrated in other applications which appeal to nanofabrication as the driving force in electronics and photonics fields.

Keywords : data storage, fluorescent compounds, laser writing, vitroceramics
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