CO_2-LASER INDUCED STRUCTURE CHANGES IN PZT SOL-GEL FILMS

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Ferroelectric thin films are still of interest as promising materials for miniature electro-optic modulators, pyroelectric detectors, piezoelectric sensors, electronic memory elements and for integration of these elements in VLSI. Ferroelectric lead zirconite-titanate $Pb(Zr_XTi_{1-X})O_3$ (PZT) is known for relatively high values of spontaneous polarisation and relative dielectric permeability. Traditional thermal treatment (electric furnace or powerful source UV irradiation) of PZT sol-gel films has problems in case of micro-composites. It does not allow local treatment of selected layers of the composites. Localised and non-destructive treatment of the surface is possible by focused laser beam or electron beam of sufficient energy. The main advantage of laser processing is selection of separate layers of a multi-layered micro-composite for treatment by choosing a suitable wavelength. Recently pulsed eximer lasers ArF (λ = 193 nm), XeF (λ = 351 nm) and XeCl (λ = 308 nm) have been used to crystallise PZT sol-gel thin films. Because the fundamental ion absorption edge of PZT layer starts at $\lambda > 6$ μm the CO_2 laser (λ = 10.4 μm) can also be used for thermal treatment of PZT films. Since materials used in microelectronics, such as Si, Ge, GaAs, are relatively transparent at $\lambda = 10.4$ μm, the CO_2 laser may be preferable. It means that it would be possible to heat the PZT film without heating the Si substrate. CO_2 laser induced transition from pyrochlore structure to the ferroelectric perovskite structure of the PZT sol-gel layer has been realised. We are going to investigate the laser treated surface of PZT film by means of atomic force microscopy.