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The effects of Fe-doping concentration in $Ba_{(1-x)}Fe_xTiO_3$ thin films on their microstructure and magnetic properties

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The effects of Fe-doping concentration in $Ba_{(1-x)}Fe_xTiO_3$ (x=0, 0.02, 0.04, 0.06 and 0.08) thin films prepared by a sol-gel method on their microstructure and magnetic properties were systematically studied. From X-ray diffraction measurements, the full width at half maximum (FWHM) of peaks were increased as the doping concentration increased. The thickness of the films measured from FESEM micrographs was about 400 nm and the grain size decreased with increasing in the Fe-doping concentration. The EDX analysis approach shows that Fe ions are substituted into Ba sites. The oxidation state of Fe in $Ba_{(1-x)}Fe_xTiO_3$ films was examined by X-ray absorption spectroscopy near the edge structure (XANES) using a synchrotron source. The ferromagnetism was observed in undoped $BaTiO_3$ and
$Ba_{(1-x)}Fe_xTiO_3$ films and found to be dependent upon Fe-doping concentration. The saturation magnetization is enhanced to a maximum value of $5.13x10^5$ emu/m^3 at x=0.02.

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