

# The influence of Mg on the properties of SrTiO<sub>3</sub> thin films

Paula Vilarinho

UNIVERSITY OF AVEIRO - PORTUGAL

## Abstract

SrTiO<sub>3</sub> (ST) films is currently considered an interesting material for tunable microwave applications. It has been reported that the dielectric losses in ST films are higher than those observed in ST single crystals. This study is aimed to study the effect of Mg on the dielectric properties of ST. For that purpose Sr<sub>1-x</sub>Mg<sub>x</sub>TiO<sub>3</sub> (SMT) and SrTi<sub>1-x</sub>Mg<sub>x</sub>O<sub>3</sub> (STM) films (with  $x = 0, 0.01, 0.05, \text{ and } 0.10$ ) were fabricated on Pt/TiO<sub>2</sub>/SiO<sub>2</sub>/Si substrates by sol-gel method. The films were deposited by dip-coating at room temperature and annealed at 750C for 60 min. The structural and microstructural properties and surface morphology of the films were analyzed by X-ray diffraction (XRD), scanning electron microscopy (SEM) and atomic force microscopy (AFM), respectively. No second phases were detected within the detection limit of XRD. The lattice parameter decreased for SMT films and increased for STM films with increasing concentration of Mg. AFM analysis showed a decrease of the grain size and roughness of STM films with increasing Mg content. The dielectric and capacitance-voltage (C-V) measurements were conducted on metal-insulator-metal (MIM) capacitors using Au as a top and Pt as a bottom electrode. The typical dielectric constant and dissipation factor of undoped SrTiO<sub>3</sub> films measured at room temperature and frequency of 10 kHz were 225 and 0.05, respectively. The dielectric constant and losses at room temperature were reduced for Sr<sub>1-x</sub>Mg<sub>x</sub>TiO<sub>3</sub> and SrTi<sub>1-x</sub>Mg<sub>x</sub>O<sub>3</sub> films. Mg doping reduces the dielectric constant, dielectric losses, tunability and capacitance of SrTiO<sub>3</sub> films.