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Synthesis of $CaSnO_3$-$SrSnO_3$ thin films by Chemical Solution Deposition

M.C.F. Alves[(1,2)*], S. Boursicot[(1)], V. Bouquet[(1)], M. Guilloux-Viry [(1)]
I. Garcia[(2)], A.G. Souza[(2)], L.E.B. Soledade [(2)]

(1) Sciences Chimiques de Rennes, UMR 6226 CNRS/ Université de Rennes 1, Campus de Beaulieu, 35042 Rennes cedex, France
(2) LACOM, Dept. de Química, CCEN, UFPB, Campus I, CEP 58059- 900, João Pessoa, PB, Brazil
* marycfa21@yahoo.com.br

Abstract – $CaSnO_3$-$SrSnO_3$ thin films were prepared on different substrates by Chemical Solution Deposition (CSD), based on polymeric precursor process. The samples were characterized by X-ray diffraction and scanning electron microscopy. Different behaviors were observed in the process of crystallization for both $CaSnO_3$-$SrSnO_3$ thin films.

The alkaline earth stannates, $ASnO_3$ (A = Ca, Sr, Ba), have been recently investigated as potential capacitor components with a small temperature coefficient of capacitance [1]. Undoped and donor-doped $SrSnO_3$ is used as a humidity sensor. The sensitivity increases with increasing donor substitution. Similarly acceptor-doped $SrSnO_3$ has high value of electrical conductivity [2]. Therefore, due to the potential of these materials for applications in electronic devices, performing their synthesis in thin film form is essential with the aim of miniaturization and integration.

In this work, $SrSnO_3$ and $CaSnO_3$ thin films were prepared by Chemical Solution Deposition (CSD) based on polymeric precursor process, using spin-coating technique. After deposition, a two-step heat treatment is performed to first eliminate the organic matter (300° C for 4h) and then to crystallize the expected phase (at higher temperature). The structure and microstructure of thin films were characterized by X-Ray Diffraction (theta-2theta, omega- and phi- scans) and Scanning Electron Microscopy (SEM).

XRD patterns show different behaviors, related to the film composition and substrate type. The $SrSnO_3$ films present the pure crystalline phase on both substrates (R-cut sapphire and (100) $SrTiO_3$) after heat treatment as low as 600° C for 2h. However, the $SrTiO_3$ substrate favors high degree of crystallization when compared to sapphire substrate. The process of crystallization of $CaSnO_3$ films occurs at higher temperature: a heat treatment at 700° C for 2h is in fact necessary to obtain the expected crystalline phase on $SrTiO_3$ but not yet on sapphire. This can be correlated to the difference of the distortion degree of the SnO_6 octahedron, which is higher for the perovskite $CaSnO_3$ than for $SrSnO_3$ due to its higher covalent character [3]. The SEM images display a homogeneous microstructure for both films with small grains.

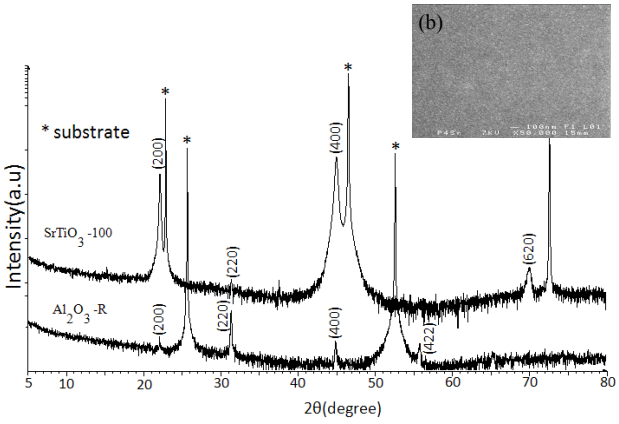

Figure 1 – $SrSnO_3$ thin films treated at 600° C for 2 h: (a) XRD patterns (b) SEM images

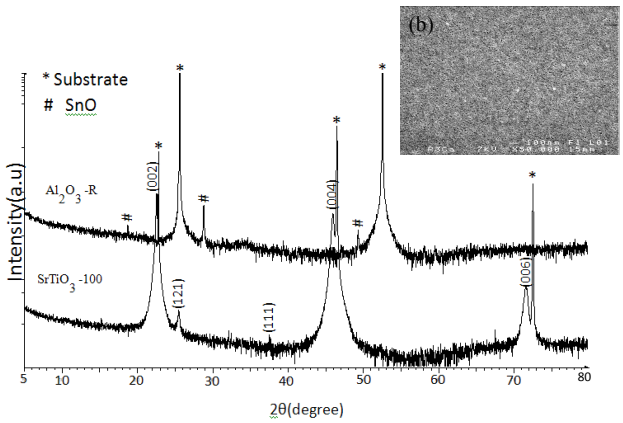

Figure 2 – $CaSnO_3$ thin films treated at 700° C for 2 h: (a) XRD patterns (b) SEM images

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