

Characterization of Photoferroelectric BaTiO₃-based Solid Solutions

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Ferroelectric solid solutions offer a possibility for engineering functional properties, for instance in the framework of photoferroelectrics the optical properties can vary in non-monotonous manner [1,2]. Understanding these variations and gaining control over them could enable the creation of new and more efficient devices integrating these photosensitive materials, and in particular in the fields of photovoltaics or photocatalysis.

In this work, we focus on BaTiO₃-based systems, since it is an environmentally friendly ferroelectric and cheap to produce. Based on ferroelectric BaTiO₃ and paraelectric BaSnO₃, we have synthesized Ba(Sn_xTi_{1-x})O₃ solid solutions [3,4], prepared as bulk powders and we have also explored their synthesis in thin film form. BaSnO₃ was chosen due to the presence of Sn 5s 5p orbitals in its conduction band [5], which could contribute to increase electron mobility in solid solutions. In addition to measuring dielectric properties, we have performed Raman spectroscopy and a study of optical properties using UV-visible spectroscopy. We have noticed a significant increase of the band gap (>0.3 eV) for $x = 0.8$ compared to the pure BaTiO₃ that we propose to explain through a detailed analysis of the spectroscopy data and in view of the changes in the local chemistry and polar properties of these compounds.

[1] Paillard C. et al., *Adv. Mat.* 28(26), 5153-5168 (2016)

[2] R. Nechache, C. Harnagea, S. Li et al., *Nat. Photon.*, 9(1), 61-67 (2015)

[3] C. Lei, A. A. Bokov, and Z.-G. Ye, *J. App. Phys.*, 101, 084105 (2007)

[4] V. V. Shvartsman, a W. Kleemann, and J. Dec et al., *J. App. Phys.*, 99, 124111 (2006)

[5] Bog G. Kim, J.Y. Jo, S.W. Cheong, *Journal of Solid State Chemistry* 197, 134–138 (2013)