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Vibrational properties of selected multicomponent perovskites

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In this work, we present selected properties of multicomponent perovskite oxides, i.e. $\text{BaZr}_{0.2}\text{Hf}_{0.2}\text{Ti}_{0.2}\text{Sn}_{0.2}\text{Me}_{0.2}\text{O}_{3-x}$, where Me = Ce, Y, Yb, Sm, In and Nb. Raman spectroscopic analyses were carried out using a spectrometer equipped with a green (514 nm) and blue (457 nm) laser. Non-resonance spectra were collected. Exemplary results obtained with the 457 nm laser are presented in Fig. 1.

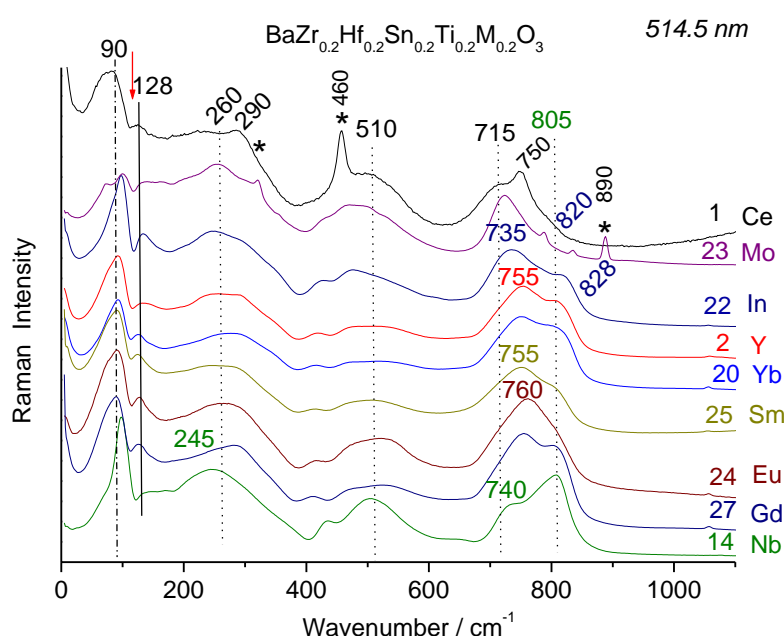


Figure 1. Raman spectra obtained with the blue laser excitation.

The spectra consist of several maxima (~ 100 (lattice mode), 250, 500 and 750 cm^{-1} (librational, bending and stretching mode of MO_6 octahedron) though the samples, within the accuracy of the X-ray diffractometry, are single-phase cubic perovskites. The lowest intensity of the Raman signals is observed in the $\text{BaZr}_{0.2}\text{Hf}_{0.2}\text{Ti}_{0.2}\text{Sn}_{0.2}\text{Ce}_{0.2}\text{O}_3$ oxide, which does not contain either acceptor- or donor-type constituents according a more cubic structure. The results are compared to those obtained in poly- and monocrystalline BaZrO_3 cubic perovskite [1]. Possible distortions from the cubic perovskite symmetry related to the presence of 5 B-site constituents are discussed.

[1] Dong-Hyeon Gim, , Yeahan Sur, Yoon Han Lee, Jeong Hyuk Lee, Soonjae Moon, Yoon Seok Oh and Kee Hoon Kim, **Pressure-Dependent Structure of BaZrO_3 Crystals as Determined by Raman Spectroscopy**, *Materials*, (15), 4286 (2022)