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Room temperature Creep and Elastic Anisotropy of $LaCoO_3$ based perovskites

NINA ORLOVSKAYA, University of Central Flroida

$LaCoO_3$ is the parent compound of the $La_{1-x}Ca_xCoO_{3-\delta}$ system that is a mixed electronic and oxide-ion conductor of technical interest for oxygen separation membranes, the cathode of solid oxide fuel cells, oxygen sensors, and catalysis. Its high-temperature properties, such as electronic-ionic conductivity, electrochemical performance, and catalytic activity, have been studied to a great extent, while the mechanical behavior of the lanthanum cobaltites is still not completely understood. $LaCoO_3$-based ceramics do not demonstrate elastic deformation during loading, but rather exhibit ferroelastic behavior with non-linearity and hysteresis, which provides time, temperature and loading rate dependent deformation. The goal of this research was to investigate room temperature creep at different stresses in polycrystalline ferroelastic LaCoO3 based perovskites under compression. The attempt was made to identify the most important parameters which affect creep strain over different time periods. New phenomenological approach of ferroelastic creep was developed to describe mechanical behavior of cobaltites. Simple analytical expression was obtained to estimate equilibrium strain at given stress. Driving force of ferroelastic switching was defined for loading and unloading and the expression was proposed that allowed calculations of characteristic time for domain switching from driving force. The anisotropy of elastic behavior of the cobaltites was also studied.