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Controlled morphotropic phase transitions by strain doping[1] ANDREAS HERKLOTZ, Oak Ridge National Lab, Oak Ridge, USA, STEFANIA FLORINA RUS, National Institute for Research and Development in Electrochemistry and Condensed Matter, Timisoara, Romania, ER-JIA GUO, ANTHONY WONG, NINA BALKE, THOMAS ZAC WARD, Oak Ridge National Lab, Oak Ridge, USA — Transitions between rhombohedral and tetragonal phases of ferroelectric oxides are of great interest since the competition of these phases at so called morphotropic phase boundaries (MPB) typically leads to extraordinary physical properties. Utilizing external parameters such as the materials composition or mechanical pressure has been the standard approach to functionalize these MPBs. Here, we demonstrate that strain doping via low-energy He implantation is an alternative, controllable, and highly flexible way to induce morphotropic phase transition in ferroelectric oxide thin films. We show that strain doping of rhombohedral $BiFeO_3$ films leads to a gradual transition to a supertetragonal phase that can be reversibly tuned by controlling the He concentration in the film. The changes in structure are shown to dramatically affect physical properties. We argue that our approach to tailor phase coexistence by strain doping is not limited to $BiFeO_3$ films, but should be widely applicable to ferroelectric thin films with competing morphotropic phases.

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