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Continuous composition spread thin films of transition metal oxides by pulsed laser deposition

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There have been numerous investigations on transition metal oxides (TMO), including cuprates, manganites, and titanates because of their interesting electric and magnetic properties. In order to more systematically explore TMO alloys with interesting physical properties, we have developed a pulsed laser deposition–continuous compositional spread (PLD-CCS) approach for fabricating as-grown epitaxial thin films. Composition spread thin film synthesis can offer an efficient means for mapping of physical properties. Our method is based on a precisely controlled synchronization between the laser firing, target exchange, and substrate translation/rotation, and offers more flexibility and control than earlier PLD-based approaches. We fabricated binary alloy composition spread films composed of conductive and dielectric perovskite materials. Alternating ablation from two different ceramic targets leads to in-situ alloy formation, and the value of x in $A_xB_{x-1}MO_3$ (A,B=Ca,Sr,Ba, M=transition metal) can be changed linearly from 0 to 1 (or over any arbitrarily smaller range) along one direction of the substrate. Details of the film growth and of their physical properties will be discussed.

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