IN-SITU GROWTH OF COMPOSITIONALLY GRADED OXIDE FILMS BY PLD

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Rapid sequential deposition of sub-monolayer amounts of different materials is an effective way to form alloys between multiple constituents without requiring a post-annealing process to promote interdiffusion. This technique is readily implemented in pulsed laser deposition, where the firing of the laser can be synchronized with the exchange of multiple targets, and where a small set of targets is sufficient to obtain films with various stoichiometries. Using appropriate automation techniques, any arbitrary composition profile perpendicular to the substrate surface can be obtained, including continuously graded profiles and periodic structures with smooth or abrupt composition variations. Differently graded materials can exhibit interesting of strain profiles that may prove useful for the stabilization of metastable phases. Results will be shown for the case of alloys between dissimilar ferroelectrics as well as between conducting and insulating perovskites. Applications to oxide electronics, mode-discriminating optical waveguides, and buffer layers for the integration of dissimilar materials will be discussed, including the development of compositionally graded buffer layers for the growth of high-T_c superconductors on metal tapes. Research sponsored by the US Department of Energy under contract DE-AC05-00OR22735 with the Oak Ridge National Laboratory, managed by UT-Battelle, LLC, and by the DOE Office of Energy Efficiency and Renewable Energy, Office of Power Technologies – Superconductivity Program.

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