

Development of Crystallographic Texture in Chemical Solution Deposited Lead Zirconate Titanate Seed Layers

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Direct seeding of {001} textured lead zirconate titanate (PZT) on platinized silicon substrates was achieved by chemical solution deposition. The processing space for {001} PZT texturing was explored, under fixed PZT pyrolysis and crystallization conditions, by varying the lead content in solution, dopant species, and PZT layer thicknesses for deposition on platinized Si substrates with different platinum grain sizes. Strong {001} texture was achieved on fine-grained (25 nm) platinum deposited at room temperature and dense, large-grained platinum (80 nm) deposited at elevated temperature. Increases in lead content of solutions (from lead excesses of 10 at.% to 16 at.%) reduced surface pyrochlore coverage, with no substantial influence on orientation or grain size. Seed layer texturing was found to be insensitive to doping (Mn and Nb) on room temperature platinum, although niobium doping increased pyrochlore coverage. Conversely, on platinum deposited at high temperature, manganese doping reduced the perovskite nucleation, producing a rosette microstructure. Undoped seed layers from 30 to 70 nm thick were found to be strongly {001} textured while thicker layers were {111} textured and thinner layers were poorly crystallized.