Title: Deposition and Characterization of $(Ba,Sr)TiO_3$ for High-Permittivity Applications

Type: Student

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Description: Thin films of $(Ba,Sr)TiO_3$ (BST) have been extensively investigated as high-permittivity materials for microelectronics applications such as dynamic random access memory (DRAM) and advanced packaging components. By controlling the bottom electrode, electrode/film interface, and film stoichiometry and structure, the dielectric properties of the film can be tailored. In this study, BST thin films will be deposited by MOCVD at low temperatures (500-575°C) using liquid delivery of metalorganic â-diketonate precursors on Pt/Ti/Si(100), Pt/Cr/Si(100), and MgO(100) substrates. A high dielectric permittivity of år ≥ 1500 and low leakage current density of $J_L < 10^{-5}$ A/cm^2 are desired. Preliminary film synthesis and subsequent characterization by Rutherford backscattering (RBS), Auger electron spectroscopy (AES) depth profiling, and grazing-incidence x-ray diffraction (GIXRD) indicate the formation of a thick titanium-rich interfacial region at the BST/platinum interface. Since titanium enrichment is not observed in deposition on MgO substrates, the unique precursor chemistry that occurs on the platinum surface plays a role in the formation of the interfacial region. The presence of the non-stoichiometric interfacial region adversely affects the dielectric properties of the films obtained thus far (år = 50-85). The origins of the interfacial region, its effect on the dielectric properties, and its reduction or elimination will be investigated. In addition, the bulk film structure and stoichiometry will be optimized to obtain the desired dielectric properties.