

IN-SITU INTEGRATED PROCESSING AND CHARACTERIZATION OF THIN FILMS OF HIGH TEMPERATURE SUPERCONDUCTORS, DIELECTRICS AND SEMICONDUCTORS BY MOCVD

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Low temperature deposition, high throughput, sharp interfaces, selective deposition with direct ion, electron, and photon beam controlled techniques, and deposition in conventional as well as atomic layer epitaxy mode are some of the attractive features of MOCVD. In addition to the well established role in semiconductor and optoelectronics industry, MOCVD is expected to play a significant role in high temperature superconductor industry. High temperature superconducting thin films as well as semiconductors and/or dielectrics are essentially required for the fabrication of superconductor and hybrid superconductor/semiconductor devices. From materials compatibility point of view, the interface between two dissimilar materials (e.g. superconductor/dielectric, semiconductor/dielectric, etc.) should have chemical, physical, and thermal integrity during and after the processing of materials. In our strategy of depositing the basic building blocks of superconductors, semiconductors, and dielectric having common elements, we have deposited superconducting films of Y-Ba-Cu-O, semiconductor films of Cu_2O , and dielectric films of BaF_2 and Y_2O_3 by MOCVD. By switching source materials entering the chamber, and by using direct writing capability complex device structure like three terminal hybrid semiconductors/superconductors transistors can be fabricated. The Y-Ba-Cu-O superconducting thin films on BaF_2 /YSZ substrates show a T_c of 80K and are textured with most of the grains having their c - axis or a - axis perpendicular to the substrate. In this paper, we will report electrical characteristics as well as structural characteristics of superconductors and related materials obtained by X-ray diffraction, SEM, TEM, and energy dispersive X-ray analysis.

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