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X-RAY MICROBEAM MAPPING OF LOCAL LATTICE ORIENTATIONS AND STRAINS IN OXIDE FILMS

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X-RAY MICROBEAM MAPPING OF LOCAL LATTICE ORIENTATIONS AND STRAINS IN OXIDE FILMS

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We have developed a polychromatic, x-ray microbeam technique for measuring the local lattice structure, crystallographic orientation (texture), and the stress/strain tensor with submicron spatial resolution. We have applied this new synchrotron technique to the study of the epitaxial growth of oxide films on highly-textured, rolled nickel substrates (for superconducting wire applications). Microbeam x-ray Laue patterns from within individual grains were collected and analyzed to obtain orientation and strain maps of each layer of multilayer structures. Crystallographic tilting of the epitaxial oxide films has been measured as a function of the miscut of individual substrate grains and as a function of the growth temperature. Quantitative results for CeO_2 films on Ni are consistent with a ledge-growth model at elevated temperatures (600°-800°C) and island growth at lower temperatures. Temperature-dependent micro-strain measurements will also be presented and compared with macro-strain results from conventional x-ray diffraction.

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