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PERSPECTIVES ON HIGH TEMPERATURE SUPERCONDUCTING ELECTRONICS

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ABSTRACT

The major challenges in making HTSC electronics viable are predominantly materials problems. Unlike their predecessors the metal oxide-based superconductors are integratable with other advanced technologies such as opto- and micro-electronics. The materials problems to be addressed relate to the epitaxial growth of high quality films, highly oriented films on non-lattice matched substrates, heterostructures with atomically sharp interfaces for junctions and other novel devices, and the processing of these films with negligible deterioration of the superconducting properties. I will illustrate these issues with results based on films prepared in-situ by a pulsed laser deposition process. Films with zero-transition temperatures of 90 K and critical current densities of $5 \cdot 10^6$ A/cm² at 77 K have been prepared by this technique. Ultra-thin films, less than 100 Å show $T_c > 80$ K, supporting the idea of two-dimensional transport in these materials. By the use of appropriate buffer layers, films with T_c of 87 K and J_c of $6 \cdot 10^4$ A/cm² have been fabricated on silicon substrates. Sub-micron structures with $J_c > 2 \cdot 10^7$ at 10 K have been fabricated. Results on nonlinear switching elements, IR detectors and microwave studies will be briefly summarized.