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Surprising Properties of Interfaces in the Cuprate Superconductors[1]

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Interfaces in the cuprate superconductors, in particular the grain boundaries, play a decisive role for the realization of large scale applications of these materials, such as superconducting power cables. The approach followed worldwide to optimize the boundaries for superconducting cables consists in aligning all grains in the cables to less than 10°, which presents an enormous effort. From the viewpoint of a solid state physicist, the grain boundaries in the cuprates are interfaces at which two oxides with highly correlated electron systems meet. If described as linear defects in the CuO_2-planes, can the properties of the boundaries be understood and new approaches for their optimization be identified? To address these questions, we have performed experiments to study the properties of these interfaces below and above the superconducting transition temperature. We find for the superconducting as well as for the normal state startling phenomena which challenge our understanding of the underlying physics.

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