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Synthesis of High-Oxidation Y-Ba-Cu-O Phases in Superoxygenated Thin Films[1] H. ZHANG, University of Toronto, N. GAUQUELIN, Canadian Centre for Electron Microscopy & Brockhouse Institute for Materials Research, C. MCMAHON, University of Waterloo, D. G. HAWTHORN, University of Waterloo & Canadian Institute for Advanced Research, G. A. BOTTON, Canadian Centre for Electron Microscopy & Brockhouse Institute for Materials Research, J. Y.T. WEI, University of Toronto & Canadian Institute for Advanced Research — It is known that solid-state reaction in ultrahigh-pressure oxygen can stabilize high-oxidation phases of Y-Ba-Cu-O superconductors in powder form. We extend this superoxygenation concept of synthesis to thin films which, due to their large proportion of surface to bulk, are thermodynamically more reactive. Epitaxial thin films of $YBa_2Cu_3O_{7-\delta}$ grown by pulsed laser deposition are post-annealed at up to 700 atm O_2 and 900°C, in conjunction with Cu enrichment by solid-state diffusion. The films show clear formation of $Y_2Ba_4Cu_7O_{15-\delta}$ and $Y_2Ba_4Cu_8O_{16}$ as well as regions of $YBa_2Cu_5O_{9-\delta}$ and $YBa_2Cu_6O_{10-\delta}$ phases, according to scanning transmission electron microscopy, x-ray diffraction and x-ray absorption spectroscopy. Similarly annealed $YBa_2Cu_3O_{7-\delta}$ powders show no phase conversion. Our results suggest that more complex phases of cuprates and other superconducting oxides may be discovered via this superoxygenation route of synthesis.

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