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Magnetron sputter deposition of a 48-member cuprate superconductor library: $Bi_2Sr_2Y_xCa_{1-x}Cu_2O_{8+\delta}$ ($0.5 \leq x \leq 1$) linearly varying in steps of $\Delta x = 0.01$.[1] KEVIN HEWITT, ROBERT SANDERSON, Dalhousie University — Using magnetron sputtering, a spatial composition spread approach was applied successfully to obtain 48-member libraries of the $Bi_2Sr_2Y_xCa_{1-x}Cu_2O_{8+\delta}$ ($0.5 \leq x \leq 1$) cuprate superconducting system. The libraries were deposited onto (100) single crystal MgO, mounted on a water cooled rotating table, using two targets: the antiferromagnetic insulator $Bi_2Sr_2YCu_2O_{8+\delta}$ (P=98 W RF) and the hole doped superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$ (P=44 W DC). A low chamber pressure of 0.81 mTorr argon is used to reduce scattering by the process gas. To minimize oxygen resputtering a substrate bias of -20 V was used as well as a process gas free of oxygen. A rapid thermal processor is used to post-anneal the amorphous deposited films following a step annealing regime - ramp at 5 °C/s for heating and cooling, with a first plateau at 780 °C held for 200 s, and a second at 875 °C held for 480 s. X-ray diffraction reveals that the films develop crystalline order with the c-axis lattice parameter contracting linearly from 30.55 Å (x=0.5) to 30.24 Å (x=1.0) with increasing Y-content, consistent with bulk values. The films are polycrystalline, developing preferred orientation for thinner members of the library. There is a change of 0.01 in doping per library member which will enable further studies to densely map phase space.

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Kevin Hewitt
Dalhousie University

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