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Densely mapping the phase diagram of the cuprate superconductor $La_{2-x}Sr_xCuO_4$ ($0 \leq x \leq 0.18$), using a spatial composition spread approach[1] KEVIN HEWITT, MEHRAN SAADAT, ANDREW GEORGE, Dalhousie University, Department of Physics and Atmospheric Science, Halifax, NS B3H 3J5 — Densely mapping the phase diagram of cuprate superconductors is the key to deciphering the normal state properties of these materials. A spatial composition spread approach was used to successfully deposit a 52-member composition spread library of $La_{2-x}Sr_xCuO_4$ ($0 \leq x \leq 0.18$). Two home made targets of La_2CuO_4 and $La_{1.82}Sr_{0.18}CuO_4$ were sputtered using 41 W RF and 42 W DC bias,respectively, at process gas pressure of 15 mTorr argon. A linear composition variation was produced by using specially designed masks in front of the La_2CuO_4 and $La_{1.82}Sr_{0.18}CuO_4$ targets. The libraries were sputtered onto $LaSrAlO_4$(001), $SrTiO_3$(100) and MgO(100)substrates through a 52-slot shadow mask, and post annealed in a two step sequence - 800^oC for 1 h then at 950^oC for 2 h - in a tube sealed with oxygen gas. XRD and WDS analysis revealed the expected doping variation. Resistivity measurements reveal expected features such as a suppression of superconductivity near $\frac{1}{8}$ (x = 0.125) doping and a novel one - that superconductivity appears near 3% (x=0.03) doping. The work present a powerful approach to studying the phase diagram of existing superconductors as well as offering a method to search for new materials.

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Kevin Hewitt
Dalhousie University, Department of Physics and
Atmospheric Science, Halifax, NS B3H 3J5

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