Densely mapping the phase diagram of the cuprate superconductor \( \text{La}_{2-x}\text{Sr}_x\text{CuO}_4 \) \((0 \leq x \leq 0.18)\), 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 \( \text{La}_{2-x}\text{Sr}_x\text{CuO}_4 \) \((0 \leq x \leq 0.18)\). Two home made targets of \( \text{La}_2\text{CuO}_4 \) and \( \text{La}_{1.82}\text{Sr}_{0.18}\text{CuO}_4 \) 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 \( \text{La}_2\text{CuO}_4 \) and \( \text{La}_{1.82}\text{Sr}_{0.18}\text{CuO}_4 \) targets. The libraries were sputtered onto \( \text{LaSrAlO}_4\)(001), \( \text{SrTiO}_3\)(100) and MgO(100) substrates through a 52-slot shadow mask, and post annealed in a two step sequence - 800°C for 1 h then at 950°C 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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