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Temperature induced epitaxial strain and superconductivity in (Cu,C)$Ba_2CuO_{4+\delta}$ thin films F.N.U. SHIPRA, University of Cincinnati, Jawaharlal Nehru Centre for Advanced Scientific Research, A. SUNDARESAN, Jawaharlal Nehru Centre for Advanced Scientific Research, SUPERCONDUCTIVITY AND MAGNETISM LAB TEAM — We have studied the effects of substrate temperature in establishing superconductivity in carbon incorporated thin films of Infinite Layered (IL) $BaCuO_{2+\delta}$. Carbon in the form of CO_3^{2-} group modulates the IL structure into a superstructure with doubled out of plane lattice parameter, 'c'. The superstructure, (Cu,C)$Ba_2CuO_{4+\delta}$ (Cu-1201) shows superconductivity within a narrow window of 'c' lattice parameter varying between 8.28 Å and 8.33 Å. The structural analysis of these thin films using reciprocal space maps (RSMs) shows a pseudomorphic growth with an in-plane lattice parameter, 'a', of 3.90 Å, similar to that of the $SrTiO_3$ substrate. Growth of these films under compressive strain is obtained at substrate temperatures varying between 530 $^\circ$C and 560 $^\circ$C. At deposition temperatures less than 500 $^\circ$C, films with a relaxed in-plane lattice parameter of 4.00 Å were obtained which were non-superconducting. Deviations in the substrate temperature led to the coexistence of strained and relaxed phases. Thus the elongation along c – axis is compensated by the compression along a– axis with increasing substrate temperature. Flexibility of tuning the in-plane mismatch between substrate and film also rule out the use of buffer layers. Such structural changes result in the change of bond lengths and subsequently rearrange the number of charge carriers in the CuO_2 planes. Optimum number of charge carriers lead to superconductivity.

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