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Tuning superconductivity by carrier injection PAUL MÜLLER, YURI KOVAL, XIAOYUE JIN, CHRISTOPH BERGMANN, YILMAZ SIMSEK, LÜTFI ÖZYÜZER, Department of Physics, Universität Erlangen-Nürnberg, Germany, HUABING WANG, NIMS, Tsukuba, Japan, GÜNTER BEHR, BERND BÜCHNER, IFW-Dresden, Germany — In layered high-temperature superconductors, like $Bi_2Sr_2CaCu_2O_{8+\delta}$, superconductivity is controlled by carrier doping of the conducting planes. Usually this is achieved by a non-stoichiometric composition. The current transport perpendicular to the planes of these layered materials shows intrinsic Josephson effects. Normally, current flow inside superconductors is never expected to be able to change the material itself. However, we were able to show that by extensive current injection along the c-axis the superconducting properties of $Bi_2Sr_2CaCu_2O_{8+\delta}$ can be changed effectively and reversibly. By injecting current perpendicular to the planes, we show that critical temperature, c-axis resistivity and critical current of intrinsic Josephson junctions can be tuned in a large range from underdoping to extreme overdoping. This effect is reversible and room-temperature stable. Apparently, the insulating layers are charged by injected carriers, and work as a floating gate. The result is hole doping of the conducting layers. This flash memory concept seems to be a general property of layered materials where the insulating charge reservoir layers are separated from the conducting planes.

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