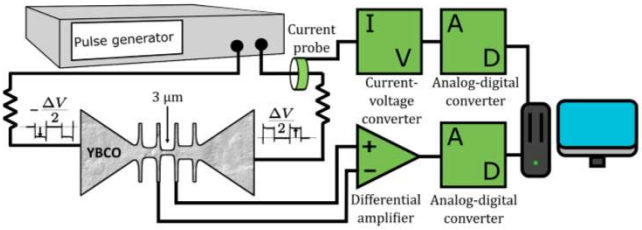
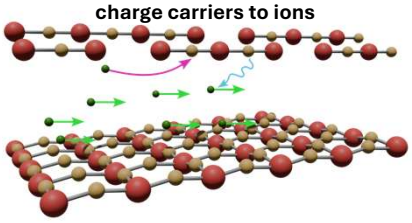
Controlling oxygen migration in $YBa_2Cu_3O_{7-\delta}$ with short current pulses and device geometry

D. Stoffels[1], C. C. Quaglio-Gomes[1,2], F. Egyenes[3], B. Aichner[4], A. Palau[5], W. Lang[4], M. Motta[2], A. V. Silhanek[1]

Current moves matter: Electromigration in $YBa_2Cu_3O_{7-\delta}$



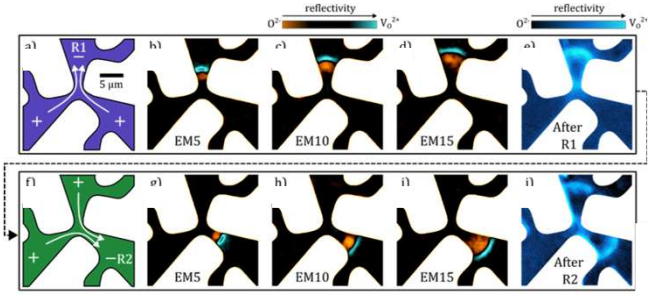
Momentum transfer from charge carriers to ions



High current densities → Oxygen migration in the crystal → Heating → Changed material properties

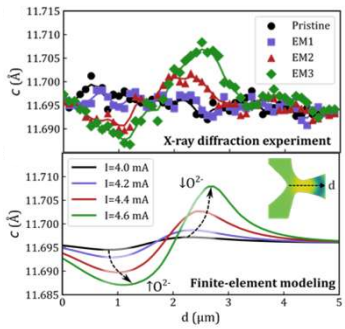
Current-path geometry guides the location and direction of oxygen migration

Optical tracking of oxygenation fronts

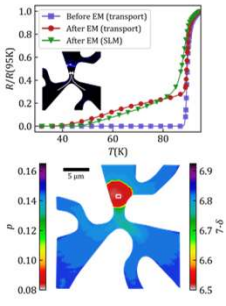


Electrical manipulation of oxygen stoichiometry in multiterminal $YBa_2Cu_3O_{7-\delta}$ junctions
arXiv:2608.26045

c-axis expansion



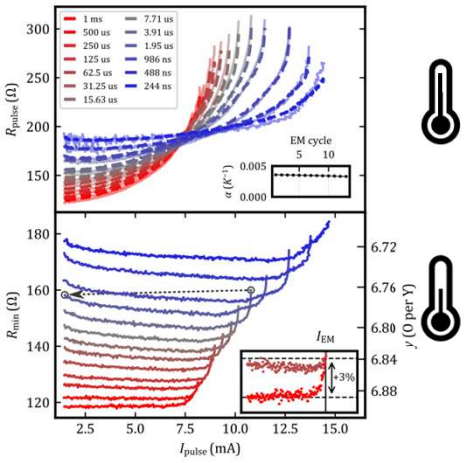
Scanning laser microscopy



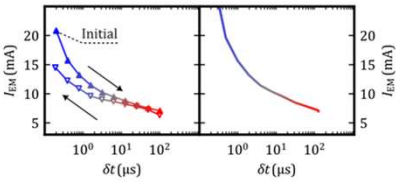
Short pulses raise the electromigration threshold by limiting heating

Effect of pulse duration on current-induced selective oxygen migration in high-Tc superconductors
arXiv:2603.15509

Resistance evolution

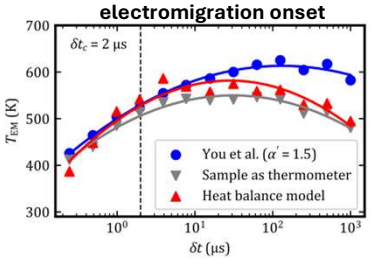


Experimental Black's model



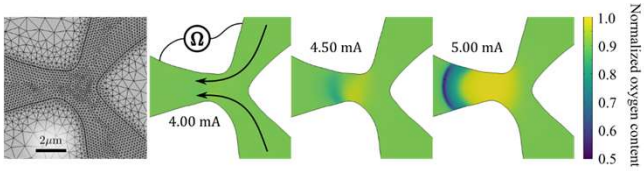
$$T_{EM} = T_0 + \frac{R_0 I_{EM}^2}{\beta - \alpha R_0 I_{EM}^2} \leftrightarrow I_{EM}^2 = AS^2 \frac{e^{U/k_B T_{EM}}}{\delta t}$$

Temperature at electromigration onset



Finite-element simulations

$$\frac{\partial C_O}{\partial t} = \nabla . D(T) \left(\nabla C_O - \frac{C_O e \rho}{k_B T} z^* \mathbf{J} \right)$$



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