Electron lattice coupling in HTSC cuprates: Evidence for polaron formation from unconventional isotope and strain effects

ANNETTE BUSSMANN-HOLDER, Max-Planck-Institute for Solid State Research, HUGO KELLER, University of Zurich, ALAN R. BISHOP, Los Alamos National Laboratory, ARNDT SIMON, Max-Planck-Institute for Solid State Research, ROMAN MICNAS, A. Mickiewicz University Poznan, K.A. MÜLLER, University of Zurich

Motivated by recent Andreev reflection experiments we use a two-component scenario to study lattice effects on the superconducting transition temperature $T_c$, the isotope exponent and strain effects in high temperature superconducting copper oxides. We find that the polaronic renormalization of the single particle energies substantially enhances $T_c$, can explain the strain induced enhancement of $T_c$ and yields the unconventional isotope effect on the London penetration depth $\lambda_L$. The lattice distortion which causes these effects is identified as the $Q_2$-type Jahn-Teller mode.

Annette Bussmann-Holder
Max-Planck-Institute for Solid State Research

Date submitted: 05 Jan 2005

Electronic form version 1.4