Molecular Crystals and Liquid Crystals Incorporating Nonlinear Optics
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/gmcl17

Direct Evidence of the Importance of Electron-Phonon Coupling in La_2CuO_4: Photoinduced IR Active Vibrational Modes

Y. H. Kim [a], A. J. Heeger [a], L. Acedo [b], G. Stucky [b] & F. Wudl [c]
[a] Department of Physics, University of California, Santa Barbara, CA, 93106
[b] Department of Chemistry, University of California, Santa Barbara, CA, 93106
[c] Department of Physics and Department of Chemistry, University of California, Santa Barbara, CA, 93106
Version of record first published: 28 Mar 2007.

To cite this article: Y. H. Kim , A. J. Heeger , L. Acedo , G. Stucky & F. Wudl (1988): Direct Evidence of the Importance of Electron-Phonon Coupling in La_2CuO_4: Photoinduced IR Active Vibrational Modes, Molecular Crystals and Liquid Crystals Incorporating Nonlinear Optics, 160:1, 483-483

To link to this article: http://dx.doi.org/10.1080/15421408808083040

Mol. Cryst. Liq. Cryst., 1988, Vol. 160, p. 483
Reprints available directly from the publisher
Photocopying permitted by license only

Printed in the United States of America

Direct Evidence of the Importance of Electron–Phonon Coupling in La_2CuO_4: Photoinduced IR Active Vibrational Modes

Y. H. KIM and A. J. HEEGER

Department of Physics, University of California, Santa Barbara, CA 93106

and

L. ACEDO and G. STUCKY

Department of Chemistry, University of California, Santa Barbara, CA 93106

and

F. WUDL

Department of Physics and Department of Chemistry, University of California, Santa Barbara, CA 93106

We present direct evidence of the importance of the electron–phonon interaction in pure La_2CuO_4. Photoinduced IR active vibrational modes (IRAV) and associated bleaching of the La_2CuO_4 phonon modes are observed in the spectral range below 700 cm^{-1}. The observation of photoinduced IRAV implies the existence of structural deformation around the photoexcited carriers, indicative of coupling of the photoexcitations to the lattice. We find, in addition, a broad photoinduced absorption which peaks at $\approx$ 0.5 eV, indicating an electronic transition deep within the energy gap.

Some specific insight into the nature of the distortion around the photoexcitations can be obtained from comparison of the photoinduced bleaching at 218 cm^{-1} and 706 cm^{-1} and the doping induced bleaching (at 218 cm^{-1} and 704 cm^{-1}). This remarkable similarity implies that locally in the vicinity of a photogenerated carrier, the CuO_6 octahedra become tetragonal (as in the Sr-doped case). The possible importance of such a specific large local structural deformation around a carrier to the occurrence of high temperature superconductivity is quite obvious.