LBL-27224
Abstract

Center for Advanced Materials

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To be presented at the 2nd Workshop on High-Temperature Superconducting Electron Devices, Hokkaido, Japan, June 7–9, 1989

High T_c Superconducting Infrared Detectors

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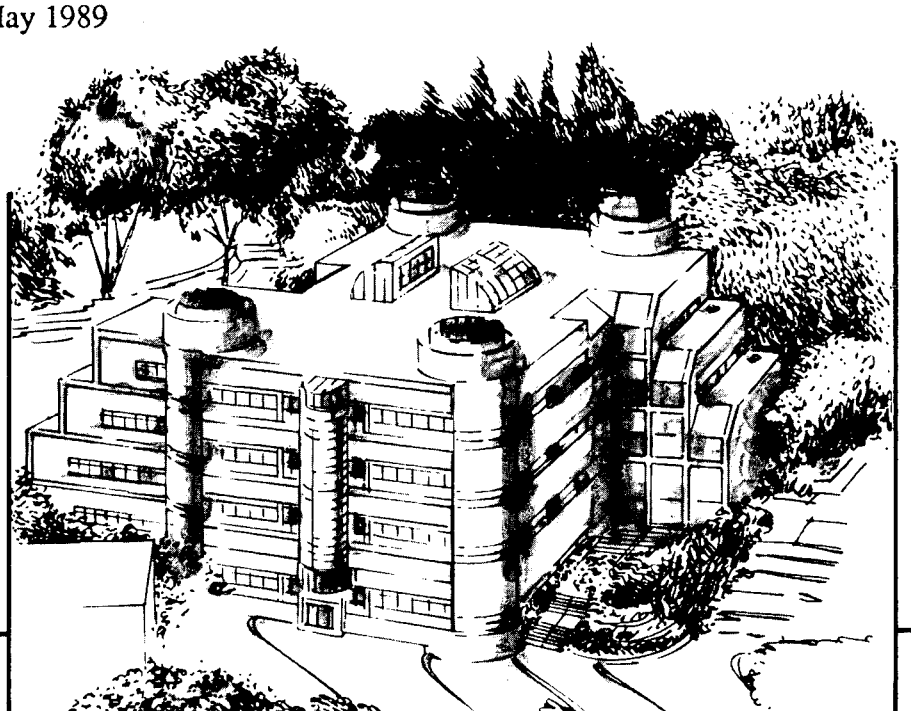
May 1989



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Prepared for the U.S. Department of Energy under Contract DE-AC03-76SF00098

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HIGH T_c SUPERCONDUCTING INFRARED DETECTORS

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ABSTRACT

A brief review will be given of published data from searches for a high T_c photon detection mechanism. Critical comments will be made about the tests used to distinguish photon and thermal detection modes. An analysis of the prospects for a high T_c bolometric detector will be presented.

RESULTS AND DISCUSSION

Much work has been stimulated by the idea that pair breaking by infrared photons in high T_c superconductors could cause modifications in film conductivity and thus lead to useful infrared photon detectors. Data have been published by many groups on the response of high T_c films with a variety of morphologies to visible and infrared photons. In general the values of specific detectivity D^* obtained are $\leq 10^8$ $cmHz^{1/2}W^{-1}$ which is too low for most practical applications. A common practice is to identify as thermal that fraction of the responsivity that scales as dR/dT, where R(T) is the film resistance. Since the responsivity also depends on temperature dependent thermal conductivities and specific heats, this practice is not reliable. Uncertainties remain as to what fraction of the observed response is thermal.

When a high T_c infrared detector is designed specifically to enhance the thermal response, values of D^* approaching 10^{11} $cmHz^{1/2}W^{-1}$ can be obtained. Such performance will be very useful, especially for infrared wavelengths longer than ~10 μm. A theoretical analysis of this high T_c bolometer will be presented.

CONCLUSIONS

(1) The thermal component of the infrared responsivity of high T_c films cannot be reliably identified as the component that scales as dR/dT.

(2) A properly optimized high T_c infrared bolometer will have useful properties.

ACKNOWLEDGMENT

Work supported by the Director, Office of Energy Research, Office of Basic Energy Sciences, Materials Sciences Division of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

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