Ultrabroadband terahertz conductivity of Si nanocrystal films

The terahertz conductivity of silicon nanoparticles embedded in glass with varying density is studied with ultra-broadband terahertz spectroscopy on picosecond time scales following fs optical excitation. The transition from relatively isolated charge carriers to densities which allow inter-particle transport is clearly observed. For the times immediately following carrier injection, we observe Drude-like long range transport that is rapidly replaced with a localized response on picosecond time scales. The localized response can be very well described by a phenomenological Drude-Smith model, verifying the applicability of this simple model to the conductivity of nanoparticle ensembles over the entire THz spectral window.

General information
Publication status: Published
Organisations: Department of Photonics Engineering, Terahertz Technologies and Biophotonics, McGill University, University of Alberta
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Number of pages: 4
Pages: 211107
Publication date: 2012
Peer-reviewed: Yes

Publication information
Volume: 101
Issue number: 21
ISSN (Print): 0003-6951
Ratings:
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.76 SJR 2.57 SNIP 1.753
Web of Science (2012): Indexed yes
Original language: English
Electronic versions:
ApplPhysLett_101_211107.pdf
DOIs:
10.1063/1.4767145

Bibliographical note
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Source: dtu
Source ID: n:oai:DTIC-ART:isi/376643870::24013
Research output: Contribution to journal » Journal article – Annual report year: 2012 » Research » peer-review