Measurement Science and Technology 2016 vol.27 N6

Microwave resonant technique in studies of photodielectric properties of bulk, thin film and nanoparticle materials

Pavlov V., Rakhmatullin R., Cefalas A., Semashko V.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016 IOP Publishing Ltd Printed in the UK.An enhanced contactless microwave technique allows us to study the photoconductivity of materials. The transient response of the complex permittivity of matter (ϵ = ϵ1 - jϵ 2) under optical irradiation is measured with nanosecond time resolution. The main advantage of the novel methodology is the elimination of the polarization effect in evaluating photoconductivity. The potential of the methodology was demonstrated by photoconductivity measurements in Si [1 0 0] crystal, CeO2 nanocrystalline powder and Ce-doped LiYF4 single crystal. The variations of complex permittivity (δϵ1 and δϵ 2) of Si [1 0 0] crystal, CeO2 nanocrystalline powder and Ce-doped LiYF4 single crystal under optical irradiation was measured and accurate values for crystalline band gaps were extracted. Finally, quantum confinement effects were observed in nano-size crystalline powders.

http://dx.doi.org/10.1088/0957-0233/27/6/065004

Keywords

microwave resonant technique, photoconductivity measurements, polarization effect