Abstracts

Microwave-Induced Thermoacoustic Effect in Dielectrics and its Coupling to External Medium--A Thermodynamical Formulation

T.C. Guo, W.W. Guo and L.E. Larsen. "Microwave-Induced Thermoacoustic Effect in Dielectrics and its Coupling to External Medium--A Thermodynamical Formulation." 1984 Transactions on Microwave Theory and Techniques 32.8 (Aug. 1984 [T-MTT] (Special Issue on Electromagnetic-Wave Interactions with Biological Systems)): 835-843.

A thorough formulation of electromagnetic wave interaction with biological systems is presented. The thermodynamic process of the microwave-induced thermoacoustic generation is clearly defined. Couplings of the acoustic and thermal energies to the surrounding medium are included through consideration of discontinuities of thermodynamical variables and microwave exposure. Contrary to prior analyses, it is shown that acoustic waves may be generated by pulsed microwaves, even in the absence of inhomogeneity of microwave absorption, owing to discontinuities of thermodynamical variables and microwave exposure conditions across the interface. General equations for the thermoacoustic waves are derived, and the validity of the first-order linear approximation is estimated in terms of its percentage error. For a system with water as the absorbing dielectric interfacing with air of 1 atmosphere pressure, the first-order approximation becomes invalid for a peak specific absorption rate greater than 13 kW/gm.

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