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On magnetic relaxation and dielectric relaxation in reacting fluid mixtures in non-equilibrium thermodynamics

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ABSTRACT. In this paper a linear theory for dielectric relaxation phenomena in polari- zable reacting fluid mixtures is developed, in the frame of thermodynamics of irreversible processes with internal variables. The microscopic irreversible phenomena giving rise to dielectric relaxation are described splitting the total specific polarization in two irreversible parts and introducing one of these partial specific polarizations as internal variable in the thermodynamic state vector. The phenomenological equations for these fluid mixtures are derived and, in the linear case, a generalized Debye equation for dielectric relaxation phenomena is derived. Special cases are also treated. Linear theories for polarizable continuous media with dielectric relaxation phenomena were derived in the same frame of non-equilibrium thermodynamics with internal variables in previous papers by one of the authors (LR). A phenomenological theory for these phenomena was developed by Maugin for complex materials, using microscopic considerations and introducing particular partial polarizations per unit mass. The obtained results in this paper have applications in several fields of applied sciences, as, for instance, in medicine and biology, where complex fluids presenting dielectric relaxation, are constitued by different types of molecules, with own dielectric susceptibility and relaxation time.

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