Energy Dissipation and Temperature Distribution in Materials Subjected to Repeated Stresses

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When real materials are subjected to repeated stresses, some energy is dissipated by internal friction and heat is generated. The detailed way in which the rate of generation of heat depends on the internal dynamical variables is different for materials which are elastic; in comparison with those in which deformations are accompanied with partial flow of matter. These viscoelastic materials may be further separated into a class in which the response to external strains is local in time (Reiner-Rivlin materials) and another in which the response depends on the entire history of the deformations. The different dissipative functions of these materials will be reviewed, with particular attention to their foundations on theoretical or phenomenological considerations. The heat produced in this way cause temperature increments, resulting in a nonuniform spatial distribution. This temperature distribution is governed by a heat transfer equation; whose origin and utilization will be discussed. Finally, we present a calculation of the heat produced —and of its resulting time-dependent temperature distribution— of a heterogeneous, technological significant, system subject to periodical loads.