
Modeling Thermo-Visco-Elastic Behavior of Polymer Materials based on Relaxation Models

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Abstract

Polymer materials are increasingly used in engineering applications due to their excellent attributes suited for lightweight engineering. To model their thermo-mechanical behaviour it is crucial to sufficiently capture relaxation effects in mechanical as well as calorical quantities (1). Ensuring thermodynamical consistency, i.e. being in compliance with the second law of thermodynamics, is a non-trivial matter for these effects. A common approach to prevent possible short-comings in modeling relaxation phenomena is to extend the variable space by additional non-equilibrium fluxes, such as the heat flux or the viscous stress tensor, which are relevant for dissipation effects (2).

In this talk we present an overview of existing relaxation models in the context of extended thermodynamic theories (2, 3). Special focus will be put on the connection to standard rheological models, e.g. the generalized Maxwell model or the Poynting-Thomson model, since they have been proven effective to deliver reasonable results for basic cases under certain assumptions. However, the here presented thermodynamic frameworks shall be used to investigate possible non-linear generalizations appropriate for a wider spectrum of applications. Subsequently a possible physical interpretation shall be given to link the theoretical framework to the ongoing microscopic mechanisms and to gain a deeper understanding of such.

REFERENCES

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