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Nonlinear thermomechanical response and constitutive modeling of viscoelastic polyethylene membranes

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Highlights

- A constitutive nonlinear thermo-viscoelastic relation is developed for an orthotropic rubbery thin film up to the onset of plasticity.
- The presented plane stress formulation involves the free volume theory of viscoelasticity and the time-temperature superposition principle.
- The constitutive model is implemented in a commercial finite element code by means of a user-defined subroutine.
- Experiments at different temperatures (from 24°C to -50°C), strain rates (from 0.001%/s to 1%/s), and mechanical loading conditions (diaphragm inflation tests and uniaxial tension, relaxation and cyclic experiments) are considered.

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