

Thermal-mechanical coupling in shear deformation of viscoelastic material as a model of frictional constitutive relations

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We propose a thermal-mechanical model of shear deformation of a Maxwell viscoelastic material to describe the temperature-dependence of friction law. The strain rate due to viscous deformation depends on temperature, while the temperature inside the layer changes owing to the competition between frictional heating and conductive cooling. By carrying out both steady-state and time-dependent calculations, we find that the behavior of the model is quite similar to the slip behavior of frictional constitutive laws which depends on state variables. The finding suggests that by further improving the present model we can develop a model of constitutive relations along faults or plate boundaries which contain temperature-dependence in a physically-sound manner.