

Rheological crossover within the framework of rate- and state-dependent friction

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We derive the rate- and state-dependent friction law starting from creep constitutive laws for a true contact patch. Consequently, the microscopic expressions for phenomenological parameters are obtained that govern the velocity dependence of steady-state dynamic friction. We show that positive velocity dependence is unlikely if the sliding and frictional healing (due to uniaxial compression) are accommodated by the same creep mechanism. We also show that friction may exhibit positive velocity dependence if the frictional healing is dominated by pressure solution.

Keywords: rate- and state-dependent friction, creep, pressure solution