



## **On the origin of power-law rheology during the evolution of damage**

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Many composite materials, including rocks undergoing semi-brittle failure by stress-enhanced corrosion reactions, exhibit power law scaling between bulk stress and strain rate. Chemical reaction rate theory on a uniform material predicts instead an exponential dependence, so mean field models to account for power law behaviour usually require a specific (often power-law) underlying distribution of local material properties to account for this, ideally conditioned on experimental and theoretical studies of microstructures. This mean field approach however breaks down at higher crack density, where bulk properties also depend on the collective dynamics or interaction of a population of microstructures. To examine the relative contribution of material heterogeneity and crack-crack interactions, we develop a 2-dimensional spring-dashpot network with breaking bonds, and investigate the influence of the distribution of microscopic relaxation times generate a macroscopic rheology of power-law form. Specifically, we examine the possibility of non-power-law microscopic heterogeneity, e.g. a Gaussian distribution of relaxation times, leading to macroscopic power-law rheology.