

Rate dependence of granular friction and its characteristic shear rate

KUWANO, Osamu^{1*}, ANDO, Ryosuke², HATANO, Takahiro¹

¹ERI, Univ. of Tokyo, ²Geological Survey of Japan, AIST

In geoscience, the rate and state-dependent friction law is established, showing negative shear-rate dependence (Scholz, 1998, Nature). In statistical physics, another empirical law holds for much faster deformation than the former, showing positive shear-rate dependence (Jop et al., 2006, Nature). However, it remains unknown how these two distinct laws are connected. In this study, we experimentally show that the crossover from negative to positive shear-rate dependence of friction coefficient occurs at a characteristic shear rate, relating to competition between two different physical processes, namely frictional healing and anelasticity. We determine the expression of the characteristic rate.

Keywords: friction, granular matter, rheology