

# Japan Geoscience Union Meeting 2011

(May 22-27 2011 at Makuhari, Chiba, Japan)

©2011. Japan Geoscience Union. All Rights Reserved.



SIT039-02

Room:301A

Time:May 24 08:45-09:00

## Origin of velocity strengthening in granular friction

Takahiro Hatano<sup>1\*</sup>

<sup>1</sup>ERI, University of Tokyo

A simple theory for a constitutive law of granular matter is presented. Starting from the energy balance equation together with the kinetics of grains, the energy dissipation rate in granular matter is estimated, which leads to a constitutive law for steady-state kinetic friction. Our theory indicates that a lower density system is stronger than a higher density system, albeit somewhat counterintuitive. This is a direct consequence from the fact that the grain rearrangement, which causes energy dissipation, is more frequent in a system of low density. Thus, the velocity-strengthening nature of granular friction is naturally explained by the negative shear rate dependence of the density. The present theory also qualitatively explains the experimental observation in which a system containing less gouge layer tends to be velocity-weakening.

Keywords: fault gouge, friction law, rheology, shear transformation zone