Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

A theory for the compression of two dimensional strongly aggregated colloidal packings[1] MAHESH TIRUMKUDULU, SAIKAT ROY, Indian Institute of Technology Bombay — The consolidation of suspended particulate matter under external forces such as pressure or gravity is of widespread interest. We derive a constitutive relation to describe the deformation of a two-dimensional strongly aggregated colloidal system by incorporating the inter-particle colloidal forces and contact dynamics. The theory accounts for the plastic events that occur in the form of rolling/sliding during the deformation along with elastic deformation. The theory predicts a yield stress that is a function of area fraction of the colloidal packing, the coordination number, the inter-particle potential, coefficient of friction and the normal and tangential stiffness coefficients. The predicted yield stress scales linearly with area fraction for low area fractions, and diverges at random close packing. Increasing the normal stiffness coefficient or the friction coefficient increases the yield stress. For stresses greater than the yield stress, both elastic and plastic deformations contribute to the overall stress.

[1]Authors acknowledge support from IIT Bombay and Dept of Science and Technology, INDIA.

Mahesh Tirumkudulu
Indian Institute of Technology Bombay

Date submitted: 30 Jul 2014 Electronic form version 1.4