

Rheology of a granular medium mixed to flexible fibers

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The introduction of a small amount of flexible fibers into a granular medium is an effective and inexpensive technique to reinforce the mechanical resistance of these materials. Although the way fibers affect the volumic fraction of a mixed of beads and fibers and the way fibers affect the flowing properties of the material is much unknown. To fill this gap, we measure the flowing response of a model material made of glass beads (diameter of order 0.3 mm) and polypropylene fibers. These fibers' length is typically centimeters and their diameters are typically of order a few 0.01 mm. To characterize the response of the medium, we use a shear vane geometry, which has been already used to characterize the rheology of pure grains. We impose the rotation speed and measure the torque required to shear the granular material mixed with fibers. It appears that with very few fibers, volumic fraction of fibers of order 0.2%, the stationnary torque is increased by 10%. We also measure the effect of the fiber's aspect ratio on the rheology of the medium. Finally, we attempt to analyse these results within the framework of $\mu(I)$ rheology developed for dry granular flows.

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