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Cohesive granular aggregates under punching: theory and experiments ALEXEI PERELET, TAPAN SABUWALA, GUSTAVO GIOIA, Department of Mechanical Science and Engineering - University of Illinois, Urbana-Champaign — When poured into a container, cohesive granular materials form low-density, open granular aggregates. If put under compression, these aggregates densify by particle rearrangement. We seek experimental evidence that particle rearrangement occurs in the form of a phase transition between two configurational phases of the aggregate (G. Gioia, A. M. Cuitiño, S. Zheng, and T. Uribe, PRL **88**, 204302, 2002). We use a simple model to show that when an open granular aggregate with two configurational phases is penetrated by a punch that lacks a characteristic length scale, the functional relation between the punching force and the penetration of the punch depends solely on the dimensionality of the punch: for a two-dimensional, wedge-shaped punch the force–penetration curve is linear whereas for a three-dimensional, conical punch the force–penetration curve is quadratic. To test these predictions we carry out experiments with open granular aggregates of a fine powder. The experimental measurements are in accord with the theoretical predictions.

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