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Phase diagram of wet granular matter under vertical vibrations
KAI HUANG, KLAUS ROELLER, STEPHAN HERMINGHAUS, Max Planck Institute for Dynamics and Self-organization — The phase diagram of vertically vibrated wet granular matter is investigated by both experiments and simulations. We find a critical point where the coexistence (C) regime of the fluid (F) and gas (G) phases terminates. The energy driven F-C transition is found to scale with the rupture energy of a liquid bridge if the corresponding vibration amplitude(A) is less than particle diameter(d). This is in good agreement with our simulations. Close to the F-G transition line, the variation of the size of the gas bubble with vibration amplitude shows a hysteretic behavior. Within the hysteresis loop, we observe temporary gas bubbles with strong fluctuations in size. The F-G boundary is shown to have an interfacial tension and non-trivial wetting behavior at container walls. Focusing on the solid (S)- F transition line, we find that the fluidization is a surface melting process. This is demonstrated by detecting the mobility of ruby tracers utilizing ruby fluorescence. This as well agrees with our simulation results.

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