PHYSICS TODAY

A gently aerated bed of glass beads sorts objects by density

The surprising discovery makes an industrial process more energy efficient.

Sung Chang 01 February 2016

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When air is injected at a high enough rate into the bottom of a container filled with powder, the powder bed can go from a solid-like state to a fluid-like one. Objects dropped onto the so-called fluidized bed sink or float depending on their density. The phenomenon finds use in industrial-scale separators like the one pictured here, which sorts plastics for recycling. Now Jun Oshitani of Okayama University in Japan, Derek Chan of the University of Melbourne in Australia, and their colleagues have found that the same job can be done with lower air flow rates that don't fully fluidize the powder and require less energy. The researchers dropped 3-cm-diameter hollow plastic spheres filled with varying amounts of iron or lead onto a gently aerated bed of 0.25-mm-diameter glass beads. Unexpectedly, for sphere densities between 1 and 1.3 times that of the bed, the less dense the sphere was, the deeper it sank into the bed. Further, the final depth of a sphere could be controlled by changing the air flow rate. The researchers conjecture that when the sphere density is close to that of the bed, rising air can lift the sphere slightly. The void that forms below the sphere allows air flow to increase and locally fluidize the bed near the sphere. But because they monitored the sinking spheres with a counterweight connected to the sphere by a line through a pulley, the researchers aren't certain what's happening inside the opaque bed. To find out, they plan to turn to MRI, high-speed x-ray imaging, or other more sophisticated tools. (J. Oshitani et al., *Phys. Rev. Lett.*, in press.)

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