Disordered Packings of the Platonic Solids and the Pentagonal Trapezohedron

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Packings of Platonic solids, a class of regular polyhedrons consisting of the tetrahedron, the cube, the octahedron, the dodecahedron and the icosahedron, provide a model environment for more complex random packing problems of faceted particles, important in materials science. Recently, they have been studied by Baker and Kudrolli in the paper "Maximum and minimum stable random packings of Platonic solids". This study intends to investigate them further and also look at the pentagonal trapezohedron, using standard sets of dice and experimental methods. The packing fraction f is determined for two packing protocols: handshaking and shaking with a laboratory shaker, both in a cylindrical container. For the handshaking protocol, f = 0.62,0.64,0.6,0.59,0.59,0.57, from lowest number of faces to highest and standard deviation up to ? ±0.02, measured through water filling and height measurement methods. Results are mainly in agreement with Baker and Kudrolli. Furthermore, the coordination number ?z? is determined for all particles except the tetrahedron, by fixating packings using candle wax and picking it apart particle by particle, counting number of contacts, giving ?z? = 5.04, 5.66, 5.81, 6.55, 6.30, from lowest number of faces to highest and standard deviation ? ±1.22.

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