Experiments with 2D quasistatic and shaken arrays of permanent magnet N-mers \((N \geq 1)\)\(^1\) PETER KOCH\(^2\), SUNY Stony Brook, MARK SHATTUCK, Levich Inst., CCNY — We extend methods used to study macroscopic grains (contact forces) to 2D \((x, y)\) arrays of N-mers of cylindrical \((L=D=3.18 \text{ mm})\) Nd-Fe-B magnets in a rectangular cell with glass plates \(\Delta z \sim 3.3 \text{ mm}\) apart and parallel to magnet faces. Aligned monomers repel with a measured \(d^{-4}\) (dipole-dipole) force dependence, with \(d\) the separation between cylinder axes. With fixed, aligned monomers separated by 6.35 mm along the cell walls, hundreds of aligned monomers can move in the cell subject to magnet-glass friction and gravity (either \(\parallel\) or \(\perp\) to \(z\)) but without contacting each other or the walls. Quasistatically moving one wall to decrease volume \(V\) increases pressure \(P\) on the magnetic particles and leads to ordering observed with annealing. Driving the array, e.g., by shaking one wall, can produce disorder; we study how this varies with driving strength at fixed \(V\) or \(P\). Replacing all non-wall monomers with similarly aligned tetramers (3 magnets magnetically bound to an inverted magnet) allows for more ordered states in quasistatic experiments; macroscopic, internal degrees of freedom into which energy can flow in driven experiments; and rearrangements (“chemical reactions”) for strong driving.

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