Significance Statement

Advances in synthetic chemistry have directed attention towards the self-assembly of anisotropic particles. Consequently, there is interest in predicting *a priori* the thermodynamic behaviors for such systems. Current theoretical developments, however, rely on virial coefficient fits from simulations and are thus both computationally expensive and limited in scope. Here, we present an equation of states for hard polyhedron that requires no fitting parameter. We then demonstrate the versatility of our theory by showing a corresponding-state behavior across shape space and predicting the order-disorder transition packing fraction. Our results provide a rapid alternative for calculating the thermodynamic properties of polyhedron fluids.