

Evaporation-Driven Assembly of Colloidal Particles

Eric Lauga, Michael P. Brenner

Division of Engineering and Applied Sciences, Harvard University

In a recent experiment by Manoharan et al. (2003, *Science*, vol. 301), a small number N of spherical particles located at the surface of a droplet self-assemble due to the droplet evaporation. Such process leads to final packings of spheres which are unique and, for N less than 11, equivalent to the minimal second moment clusters as studied by Sloane et al. (1995, *Discrete Comput. Geom.*, vol. 14). We first use numerical simulations to reproduce the packings of Manoharan et al. We then study theoretically the packing selection problem. We show that at the smallest droplet volume below which the droplet can no longer remain spherical, the packing of spheres on its surface is unique and independent of the liquid-solid contact angle. We then use a perturbation analysis to characterize the rearrangement of the spheres at this point and we show that for N less than 18, the rearrangement of the sphere is unique and purely geometric.

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