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Statistical Mechanics of Thermosensitive Nanoparticle Binding: Quantyfing Hydrophobic Interactions in Bulk Solution ALESSIO ZACCONE, Cavendish Laboratory, University of Cambridge, JEROME CRASSOUS, University of Lund, BENJAMIN BERI, Cavendish Laboratory, University of Cambridge, MATTHIAS BALLAUFF, Helmhotz Zentrum Berlin — We present a novel method which allows one to quantify the binding energy between complex hydrophobic nanoparticles in bulk aqueous solutions by means of light scattering. We tested the method on the case of thermosensitive nanoparticles made of a solid polymeric core onto which a thermosensitive p-NIPAM microgel shell is grafted. The microgel shrinks above a critical T at which the hydrophobic attraction sets in. By means of a novel statistical mechanics model to interpret the data, we manage to demonstrate that the binding energy as a function of T of thermosensitive nanoparticles behaves like in the case of neat two-level systems, with a rather sharp transition from hard-sphere (hydrophilic) to attractive (hydrophobic) at the critical temperature. The model allows us to make a clear quantitative connection between the binding energy and the entropy change of the grafted microgel upon going from hydrophilic to hydrophobic (in turn related to the microgel structure). The methods presented in this work can be applied to quantify the binding energy of complex biomolecules in bulk solution, which is a major challenge in biophysics nowadays. Reference: A. Zaccone, J.J. Crassous, B. Beri, and M. Ballauff, Phys. Rev. Lett. 107, 168303 (2011).

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