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Controlling dense suspension flows through particle solvation¹

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University of Chicago — Dense suspensions often exhibit non-Newtonian flow behaviors such as shear thinning at low applied stresses followed by a transition to shear thickening at higher stresses. While recent work has shown that both shear thinning and thickening can be tuned by independently manipulating solvent identity or particle surface chemistry, a holistic understanding of these intertwined factors and its corresponding effect on flow behavior is lacking. We report the steady state rheology of silica particles as a function of solvent molecular weight (MW) and surface chemical functionalities. We find that the shear thinning, shear thickening, and the stress-dependent transition between these two regimes is highly sensitive to both solvent MW and particle surface chemistry. Our results demonstrate that these two factors conspire to control particle surface solvation, which is what ultimately controls the flow behavior of dense suspensions.

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