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Leigh Ann Green

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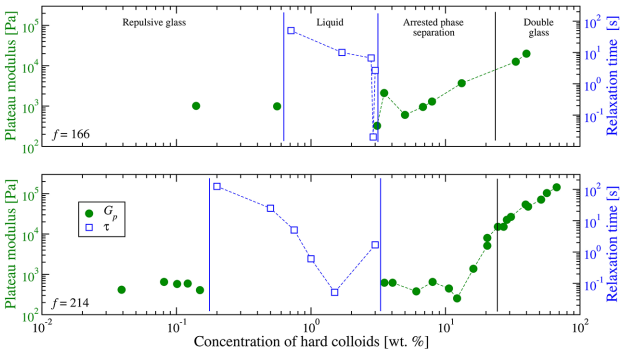
Small changes in the molecular architecture of soft particles are introduced to impact the state diagram of colloidal mixtures.



Soft-hard colloidal mixtures are traditionally composed of relatively hard colloids and smaller linear polymers. Parisi, et al, compared a theoretical model of the structural and dynamic properties of these mixtures to rheological data obtained while manipulating the softness and size ratio of the components.

In this research, the depletion mechanism explaining the effective interaction between particles was effectively tuned through component architecture. Soft colloids were mimicked by large star polymers with high functionality. Hard colloids were simulated by smaller stars with ultrahigh functionality. The study showed small variations in component softness and size resulted in major changes to the mixture's flow properties.

The addition of small amounts of hard colloids to the dense soft colloid solution created a significant impact on the dynamical state of the mixture, moving the mixture from a solid-like, repulsive glass to a liquid state to two other types of disordered solids, including one double glass and one with arrested phase separation.

"The results obtained in this work show that the range of hard spheres concentration where the different transitions take place can be modulated to a large extent by the different softness and size ratios" said Manuel Camargo, one of the study's authors.

Soft colloids are found naturally in cells. They can be also made industrially for use in food, cosmetics, pharmaceuticals, and oil production. Camargo said this work provides a way to target a desired rheological response of a colloidal mixture based on molecular characteristics of the mixture's components.

Source: "Effect of softness on glass melting and re-entrant solidification in mixtures of soft and hard colloids," by Daniele Parisi, Manuel Camargo, Kalliopi Makri, Mario Gauthier, Christos N. Likos, and Dimitris Vlassopoulos, *Journal of Chemical Physics* (2021). The article can be accessed at https://doi.org/10.1063/5.0055381.

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