Z-SHAPED DEJAMMING PHASE DIAGRAM OF COLLOIDAL GELS

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ABSTRACT

For physically gelled colloidal suspensions, there are two routes that can transform the gel from solid to liquid. One is to raise the temperature, and the other is to increase the shear deformation. In this investigation, we found that the phase boundary of this solid-to-liquid transformation exhibits a surprising Z-shaped curve in the strain-temperature plane. This non-monotonic feature in the phase transition appears to be present in various nanoparticle-filled colloidal gels with significant differences in chemical composition, filler type, structure, particle shape, average diameter and particle size distribution. By applying the Kraus model[1] to the breakage and restoration of filler network and comparing our findings to nonequilibrium glassy behavior, we found that this non-monotonic phenomenon can be theoretically predicted by combining the glassy melting kinetics of filler network at high temperatures with the viscosity-retarded dissociation[2] between particles at low temperatures.

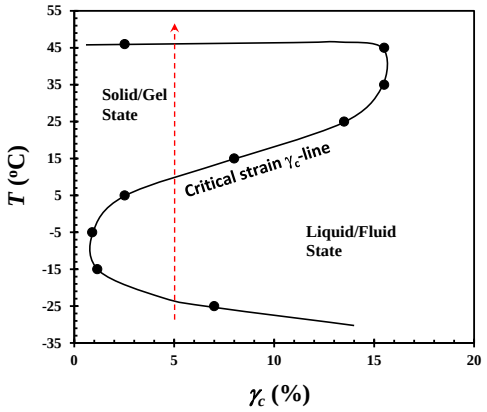

Figure 1: Relationship between critical strain and temperature for a 18 vol% nanoparticle colloidal gel. The data are taken from the crossovers of *G'* and *G"* under strain sweep tests with varying temperature.

REFERENCES

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