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Power-law creep and residual stresses in carbopol microgels

PIERRE LIDON, SEBASTIEN MANNEVILLE, Physics Laboratory - Ecole Normale Supérieure de Lyon - France — We report on the interplay between creep and residual stresses in carbopol microgels. When a constant shear stress σ is applied below the yield stress σ_c , the strain is shown to increase as a power law of time, $\gamma(t) = \gamma_0 + (t/\tau)^\alpha$, with an exponent $\alpha \simeq 0.38$ that is strongly reminiscent of Andrade creep in hard solids. For applied shear stresses lower than some characteristic value of about $\sigma_c/10$, the microgels experience a more complex creep behavior that we link to the existence of residual stresses and to weak aging of the system after preshear. The influence of the preshear protocol, of boundary conditions and of microgel concentration on residual stresses is investigated. We discuss our results in light of previous works on colloidal glasses and other soft glassy systems.

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