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Flow induced by a sphere settling in an aging yield-stress fluid

BLANDINE GUESLIN, Laboratoire FAST Orsay Institut Français du pétrole present address: Institut de Physique du Globe de Paris, LAURENCE TALINI, Laboratoire FAST Orsay present address: PPMD ESPCI Paris, BENJAMIN HERZHAFT, YANNICK PEYSSON, Institut Français du Pétrole, CATHERINE ALLAIN, Laboratoire FAST Orsay — The settling of non-Brownian spheres in a laponite suspension has been studied experimentally. A specific preparation of the fluid has been set up and the fluid's rheology has been characterized. A suspension of laponite constitutes a yield stress, shear thinning and viscoelastic fluid that exhibits aging, i.e. in particular an evolution with time of its rheological properties. The settling of single spheres has been studied in the case of low Reynolds numbers. The velocity of a sphere slows down exponentially with aging time. Two flow field patterns around the sphere have been observed according to the stress exerted by the sphere on the fluid: the flow exhibits either a negative wake (an upward motion in the wake of the sphere) for large stresses or not for smaller stresses. A link between the presence of the negative wake and the viscoelastic properties of the fluid has been established.

Blandine Gueslin
Laboratoire FAST Orsay Institut Français du pétrole present address:
Institut de Physique du Globe de Paris

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