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Controllable adhesion using field-responsive fluids RANDY EWOLDT, GARETH MCKINLEY, A.E. HOSOI, MIT — Viscous Newtonian fluids confined in sufficiently small gaps can provide strong resistance to the separation of two parallel rigid surfaces, a phenomenon known as Stefan adhesion. However, the resistance to a shear load is considerably lower than for normal loads in such confined geometries. In principle, a field- responsive "smart" fluid, which exhibits a field-dependent microstructure with dramatically increased resistance to shear loading, can be used in place of a Newtonian fluid enabling externally-tunable adhesion. We report experimental results for both normal and shear loading of field-responsive, non- Newtonian fluids confined between rigid surfaces as the external magnetic field, the geometry of the adhesive contact pad, and the roughness of the adherent are varied. The peak adhesive force, the "work of adhesion" and the mode of failure are all controlled by the field-responsive nature of the magnetorheological fluid forming the adhesive layer.

Randy Ewoldt
MIT

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