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YIELD STRESS OF A COMPLEX LIQUID

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The yield stress of a complex liquid is analyzed with the Bautista-Manero-Puig (BMP) constitutive equation, consisting on the Upper-Convected Maxwell equation coupled to a kinetic equation to account for the breakdown and reformation of the fluid structure. In the regime when the shear stress is independent of the shear strain the system present a yields stress behavior which depends on the structural, kinetic and viscoelastic contributions. In terms of the fluidity φ (inverse shear viscosity), a real yield stress is predicted when $\varphi=0$, while for very low values of φ the yield stress is only apparent, which is directly associated to the situation where the yield stress depends on the rheometer resolution.

The influence of the structural, kinetic and viscoelastic properties of the solution is analyzed through dimensionless numbers associated to the relevant mechanisms that give rise to the yield stress in complex materials. Results are analyzed and compared to other rheological models which also predict the yield stress.