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Shear alignment of lamellar mesophase systems[1] JAJU S.J., KUMARAN V., Indian Institute of Science, Bangalore 560 012, India. — Mixtures of oil, water and surfactants form different microphases. Some of these phases, e.g. lamellar, hexagonal phases, lead to complex rheological behaviour at macroscale due to inherent anisotropy and irregularities in the microstructures. We present a comprehensive simulation study to examine the structure-rheology relationship in lamellar phase flow. At mesoscale, Reynolds number (Re), Schmidt number (Sc), Ericksen number (Er), extent of segregation between hydrophilic and hydrophobic components (r), ratio of viscosity of the two components ($\Delta\mu/\mu_0$), and system size to layer width ratio (L/λ) complete the lamellar phase description. We have used lattice Boltzmann simulations to study a two dimensional lamellar phase system of moderate size. The domains and grain boundaries seen at low Sc are replaced by isolated edge dislocations at high Sc. The alignment mechanism does not change with changes in layer bending moduli (Er), viscosity contrast or r. Increasing segregation, increases disorder; this however does not lead to higher resistance to flow. At high Er, the shear tries homogenise the concentration field and disrupt layer formation. We see significantly higher peak viscosity at low Er at high viscosity contrast and due to defect pinning.

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