

Magnetic Particles Aggregation in the Presence of a Hydrodynamic Shear

Guillaume Degre, Edouard Brunet, Fridolin Okkels, Patrick Tabeling

ESPCI, Paris, France

We present an experimental study of the aggregation of paramagnetic particles, carried out in the presence of a controlled laminar shear, in micro-channels. Superparamagnetic particles, advected by the flow, and immersed in a magnetic field, are found to spontaneously form chains. In a range of time extending up to hundreds of seconds, the growth mechanism is an accumulation of isolated particles or small clusters onto existing chains, moving at different speeds. In this range of time, the chain length increases linearly with time, with a growth rate increasing as a power law with the shear. Smoluchowsky model, assuming single particle-chain interactions only, reproduces well the observations, both at quantitative and qualitative levels. In particular the evolution of the growth rate of the chain lengths with the shear, predicted as a power law with an exponent equal to 0.25, is found consistent with the experiment.

[View the extended summary](#)