Simulations of the Lifshitz-Slyozov equations: the role of coagulation terms in the asymptotic behavior

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We consider the Lifshitz-Slyozov system that describes the kinetics of precipitation from supersaturated solid solutions. If we denote by $f(t, x)$ the polymer density at time $t$ and size $x$, and by $c(t)$ the monomer density, the system reads

\[
\begin{aligned}
\partial_t f + \partial_x(Vf) &= 0, & t \geq 0, & x \geq 0, \\
V(t, x) &= x^{1/3}c(t) - 1, & t \geq 0, & x \geq 0, \\
c(t) + \int_0^\infty xf(t, x)dx &= \rho, & t \geq 0,
\end{aligned}
\]

where $\rho$ is the initial (given) total mass of monomer and polymer.

We design a specific Finite Volume scheme to investigate numerically the behavior of the solutions, in particular the large time asymptotics. Our purpose is two-fold: first, we introduce an adapted scheme based on downwinding techniques in order to reduce the numerical diffusion; second, we discuss the influence of coagulation effects on the selection of the asymptotic profile. This allows to understand better some conjectures by Lifshitz and Slyozov.

Some important references for this system are

References


Joint work with: Thierry Goudon, (INRIA Sophia Antipolis) and Léon Matar Tine (Université Paris Descartes)