

Derivation of surface tension of grain boundaries in polycrystals

Inspired by a recent result of Lauteri and Luckhaus, we derive, via Gamma convergence, a surface tension model for polycrystals in dimension two. The starting point is a semi-discrete model accounting for the possibility of having crystal defects. The presence of defects is modelled by incompatible strain fields with quantised curl. In the limit as the lattice spacing tends to zero we obtain an energy for grain boundaries that depends on the relative angle of the orientations of the two neighbouring grains. The energy density is defined through an asymptotic cell problem formula. By means of the bounds obtained by Lauteri and Luckhaus we also show that the energy density exhibits a logarithmic behaviour for small angle grain boundaries in agreement with the classical Shockley Read formula.

The talk is based on a paper in preparation in collaboration with Emanuele Spadaro.