

Growth and coarsening of quantum dots on a strained semi-conductor film

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The shapes of solid crystals have a great interest in science both from a fundamental and applied perspective. The formation, morphology and properties of a crystal result from the competition between several subtle effects, such as for example the mechanical stresses and the surface energy anisotropy. In particular, solid semi-conductor nanocrystal, coined as quantum dots, are under active experimental and theoretical investigations due to their photovoltaic and opto-electronic properties.

In this work, I will review and describe the dynamics and the morphology of quantum dots on an elastically strained semi-conductor solid film.

I will first review the Asaro-Tiller-Grinfeld instability, using the continuum elasticity framework and describe the effect of the wetting potential[1]. I will discuss the effect of the interplay between the surface diffusion, the long range elastic effect, the capillary effect and the non-linear geometrical effect on the shape and size of quantum dots. An analytical method will be described, which leads to the determination of the height of the islands (quantum dots) as a function of the mass deposited[2]. I will present results on the dynamics of coarsening of two islands as a function of their distance. I will show that the dynamics of coarsening of two islands can be reduced to a simple model which can be easily integrated.

Finally, I will briefly discuss the comparison between the theory and the experiments on quantum dots in hetero-epitaxy in semi-conductor film[3].

Références

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