

MODELING BIOMINERALIZATION USING LIPID SURFACES

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Almost all biological organisms form inorganic crystals of defined shape and orientation [Weissbuch, I. *et al.* **Crystal Growth Design** 3 (2003) 125]. In vertebrates, for example, apatite crystals are formed in bones and teeth [Hoang, Q.Q. *et al.* **Nature** 425 (2003) 977]. There has been considerable interest towards creating artificial templates facilitating and controlling crystal nucleation [Buijnsters, P.J.J.A. **Langmuir** 17 (2001) 3623 and Didymus, J. M. *et al.* **Langmuir** 11 (1995) 3130] that is classically described in terms of two steps: aggregation of the dissolved molecules in clusters and the following continuous growth after the nucleus reaches the critical size. Detailed nature of the mechanisms involved in crystallization is uncertain but, nevertheless, direct electrostatic interactions as well as hydrophobic interactions are involved. Synthetic monolayer templates can be used for enhancing both the aggregation and stabilization of the desired nucleus and epitaxial growth on Langmuir monolayers has been reported for different substances such as CaCO₃, BaF₂ and NaCl. In these systems the subphase has been supersaturated with the ions and the monolayer has basically been used as a platform to orient the mineral growth. Some recent studies indicate, however, that clusters form also in moderate concentrations [Georgalis, Y. *et al.* **J. Phys. Chem. B** 104 (2000) 3405].

We demonstrate here that by specific tuning of the effective molecular geometries of amphiphiles very different inorganic crystal growth can be induced using non-saturated salt solutions. The crystal formation could be induced in Langmuir films with microscopy of the surface revealing crystal-like aggregates in the interface and similar results were obtained using vesicles formed by the amphiphiles confirming crystallization with undersaturated solutions. The kinetics of the process was very rapid and the phenomenon did depend on the nature of the salt, thus readily indicating specific mechanism for crystallization. Exact geometrical match between the charges of the amphiphile and those of salt crystal lead to formation of a supported lattice facilitating aggregation of ions thus enabling the crystallization in dilute solutions.

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