Molecular mechanisms of crystallization and defect formation

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Using the atomic force microscope (AFM) *in-situ* during the crystallization of the protein apoferritin, we show that for this system the kink density along the steps is an equilibrium property that, multiplied by the frequency of molecular attachment, fully determines the propagation of growth steps. The intermolecular bond energy is 3.2 k_BT. Point defects are non-equilibrial and are caused by incorporation of impurity molecules and replicate in subsequent layers due to the strain they cause. Using single-molecule manipulation with the AFM tip, the defects can be healed to restore the regular lattice.

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