Polymerization-like kinetics in crystal growth

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We will review recent results concerning the growth kinetics of ensembles of nanocrystals in solution in the presence of surface capping ligands. The evidence suggests that crystal growth can be modeled with the same kinetic models employed to describe polymerization, specifically step-growth polymerization [1]. Specifically we will show how the growth of ultrathin Bi_2S_3 nanowires could be effectively modeled as a combination of monomer addition processes as well as coupling processes (e.g., oriented attachment) [2].

Our recent work in that crystal system attempts to eliminate the addition process by removing supersaturation and by generating a stable, measurable, and monodisperse initial dispersion of "monomers" (i.e., very short Bi_2S_3 nanowires) obtained by fragmenting the as-synthesized nanowires. Our results indicate that the "monomers" produced in this manner can recouple together to form long nanowires, thereby demonstrating that the process is best described as a living polymerization [3].

In conclusion we will review the challenges [4] and opportunities [5] associated with performing rigorous kinetic studies of crystallization in these systems and present these Bi_2S_3 nanowires as a unique model system to study these processes [6].

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