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Nucleation and Growth; 1.5.1.1 Homogeneous and Heterogeneous Nucleations; 1.5.1.2 Defects in Seed Crystal; 1.5.1.3 Growth of Seed Crystal; 1.5.2 Reaction Parameters; 1.5.2.1 Reactants and Their Concentrations; 1.5.2.2 Additives/Impurities; 1.5.2.3 Solvent, pH, and Temperature; 1.6 Mechanisms of Morphology Evolution
1.6.1 One-Dimensional Nanoparticle Formation1.6.1.1 Nanorod Formation; 1.6.1.2 Nanobipyramid Formation; 1.6.2 Two-Dimensional Nanoparticle Formation; 1.6.3 Three-Dimensional Polyhedral Shape Evolution; 1.6.4 Epitaxial/Core-Shell/Heterodimer/Overgrowth Mechanism; 1.6.5 Branched Nanoparticle Formation; 1.6.6 Hollow/Porous Nanoparticle Formation; 1.7 Conclusions and Outlook; References; 2 Controlling Morphology in Noble Metal Nanoparticles via Templating Approach; 2.1 Introduction; 2.2 Galvanic Replacement Method; 2.2.1 Synthesis of Quasi-Zero-Dimensional Nanoparticles
2.2.2 Synthesis of One-Dimensional Nanostructures2.3 Hard Template-Directed Method; 2.3.1 Porous Membrane Template-Directed Method; 2.3.2 Pattern Template-Directed Method; 2.4 Soft Template-Directed Method; 2.4.1 Micelle Template-Directed Synthesis; 2.4.2 Selective Adsorption-Directed Synthesis; 2.5 Conclusions and Outlook; References; 3 Shape-Controlled Synthesis of Metal Nanoparticles of High Surface Energy and Their Applications in Electrocatalysis; 3.1 Introduction; 3.2 Fundamentals and Background; 3.2.1 Thermodynamics of Crystallization: Principles and Rules
3.2.1.1 Equilibrium Shape of a Crystal3.2.1.2 Nucleation; 3.2.1.3 Three-Dimensional Growth of a Crystal on Substrate; 3.2.1.4 Two-Dimensional Nuclei Theory; 3.2.2 Correlation of the Shape of Crystal and Its Surface Structure; 3.3 Progress in Shape-Controlled Synthesis of Metal Nanoparticles of High Surface Energy and Their Applications; 3.3.1 Electrochemistry Route; 3.3.1.1 Pt and Pd Nanoparticles; 3.3.1.2 Fe Nanoparticles; 3.3.2 Wet Chemistry Route; 3.3.2.1 Au Nanoparticles; 3.3.2.2 Pd and Pd-Au Nanoparticles; 3.3.2.3 Pt Nanoparticles
3.4 Theoretical Simulations of Structural Transformation and Stability of Metal Nanoparticles with High Surface Energy

Sommario/riassunto

The past few years have witnessed the development of non-spherical metal nanoparticles with complex morphologies, which offer tremendous potential in materials science, chemistry, physics and medicine.Covering all important aspects and techniques of preparation and characterization of metal nanoparticles with controlled morphology and architecture, this book provides a sound overview - from the basics right up to recent developments. Renowned research scientists from all over the world present the existing knowledge in the field, covering theory and modeling, synthesis and prope

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