Chapter 7
Conclusions and Trajectories for the Future

As a new crystal growth mechanism, OA growth has developed into a fundamental growth mechanism in the general materials field. Compared with the traditional OR growth mechanism, OA presents a unique growth pathway and characteristics. Since the OA is the self-assembly of primary particles, this bottom-up fabrication method can produce novel materials with various properties while retaining the original structures and properties of their building blocks. In short, this new growth mechanism indeed opens up an efficient alternative avenue to rationally designing and synthesizing various advanced materials with controllable scale, unique structures, and multi-functionalities, which can be used in many energy devices, including fuel cells, batteries, supercapacitors, solar cells, photocatalysis, etc.

For further advances in synthesis of various nanostructures in energy devices via the OA mechanism, more efforts should be focused on the following challenges. The mechanism and kinetics of OA growth should be investigated further. Undoubtedly, the emerging OA mechanism plays an important role in the field of crystal synthesis with controllable size and morphology. Currently, most syntheses of nanocrystals are mainly based on the OA growth kinetic control. A better understanding of crystal OA growth kinetics is required to effectively tailor and predict the properties of materials. In practice, we are still far away from a comprehensive understanding of this new growth mechanism and kinetics and, thus, it is necessary to investigate further this emerging mechanism and kinetics both experimentally and theoretically. Currently, OA growth mechanism is employed mainly to explain the formation of nanomaterials with various morphologies, while the controllable synthesis of targeting nanostructures via OA mechanism is rare. Towards real-life applications, the shape and size-controlled fabrication of most complex nanostructured materials in energy and environmental devices with high performances is required.

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