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Electrodeposited Ge Nanostructures Prepared by Different Non-Aqueous Solutions and their Application in Lithium Ion Battery: A Review.

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Abstract

BACKGROUND: Germanium (Ge) nanostructures exhibit wide range of potential applications in the field of nanoscale devices due to their excellent optical and electrical properties and have gained significant interest due to the Bohr exciton radius. Bohr radius of Ge (24.3 nm) is larger than that of Si (4.9 nm), leading to quantum size effects and nanostructures with controllable bandgaps.

METHODS: This article provides a comprehensive review on various electrolytes for electrodeposition procedures developed to obtain the Ge nanostructures of desired structure, diameter, and density. We discuss the growth mechanisms and influence of different parameters such as type of solution, concentration, and value of applied potential or current density.

RESULTS: The ionic liquids can be used for the development of Ge nanostructures and provide extensive electrochemical windows for electrodeposition. The obtained SixGe1-x structures also exhibited strong color change (from red to blue) at room temperature during the electrodeposition, which is likely to be due to a quantum size effect.

CONCLUSION: The main advantages of the ionic liquids are 'it does not decompose', easy to purify and dry. Moreover, it exhibits fairly extensive electrochemical windows greater than 5 V for electrodeposition. Electrodeposition of SixGe1-x nanostructures from ionic liquids is quite a favorable process. The 3DOM Ge electrode is a promising material for nextgeneration lithium ion battery because of its high irreversible specific capacity. Few relevant patents to the topic have been reviewed and cited.

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