Effect of Morphology on the Thermodynamic function of A-TiO₂ Nano-Materials

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The thermodynamic functions of A-TiO₂ nano-materials with different shapes (nanowires, nanotubes, nanoflakes and nanoparticles) were investigated by Faraday's law and open-circuit potentiometry. The results showed that the A-TiO₂ nanoparticles have the highest chemical activity (nanoparticles > nanoflakes > nanotubes > nanowires) at the same size, and the corresponding free energies and enthalpy are $\Delta G = -895.59 \text{ kJ} \cdot \text{mol}^{-1}$, $\Delta S = 76.09 \text{ J} \cdot \text{K}^{-1} \cdot \text{mol}^{-1}$, $\Delta H = 847.21 \text{ kJ} \cdot \text{mol}^{-1}$; However, the stability of A-TiO₂ nanowires is the best (nanowires > nanotubes > nanoflakes > nanoparticles), and the ionic diffusion coefficient is lower than other structures (nanowires < nanotubes < nanoflakes < nanoparticles). There are more surface-active spots in nanometer-sized A-TiO₂, which makes it more likely to lose electrons in the equilibrium state. This work intends to provide a reference for the design and analysis of various nanostructured materials.

Keywords: Nanostructure; A-TiO₂; Thermodynamic property; Diffusion coefficient; Form effect

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