

Preparation of (Li,K)-codoped WO₃ for Smart Windows by One-step Hydrothermal Reaction

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Semiconductor materials with selectively controllable near-infrared (NIR) properties have attracted extensive attention as a potential way to improve the energy efficiency of smart-window applications in energy-saving buildings. Among semiconductors, tungsten trioxide (WO₃) is considered as a promising candidate for smart windows due to its unique electrical and optical properties.

In this work, a new semiconductor material, (Li,K) - codoped WO₃, with an enhanced NIR shielding ability was successfully prepared via a simple one-step hydrothermal reaction. Transmission electron microscopy (TEM) images showed that the prepared products possessed a nanorod-like morphology with diameters of about 5 - 10 nm, as presented in Figure 1. Moreover, Figure 2 displays the transmittance spectra of the films coated by different samples. Because of the wide band gap and empty conduction band, the WO₃ film shows a high transmittance in the Vis - NIR range. In contrast, films coated with Li - WO₃, K - WO₃ and (Li,K) - WO₃ retain relatively high transparency in Vis (approximately 71%) and a strong shielding ability in NIR range. It was demonstrated that (Li,K)-codoped WO₃ presents a better NIR absorption ability than pure, Li-monodoped or K-monodoped WO₃. Optical tests demonstrated that an enhanced NIR shielding ability is achieved after the incorporation of Li and K, compared to Li-monodoped and K-monodoped WO₃.

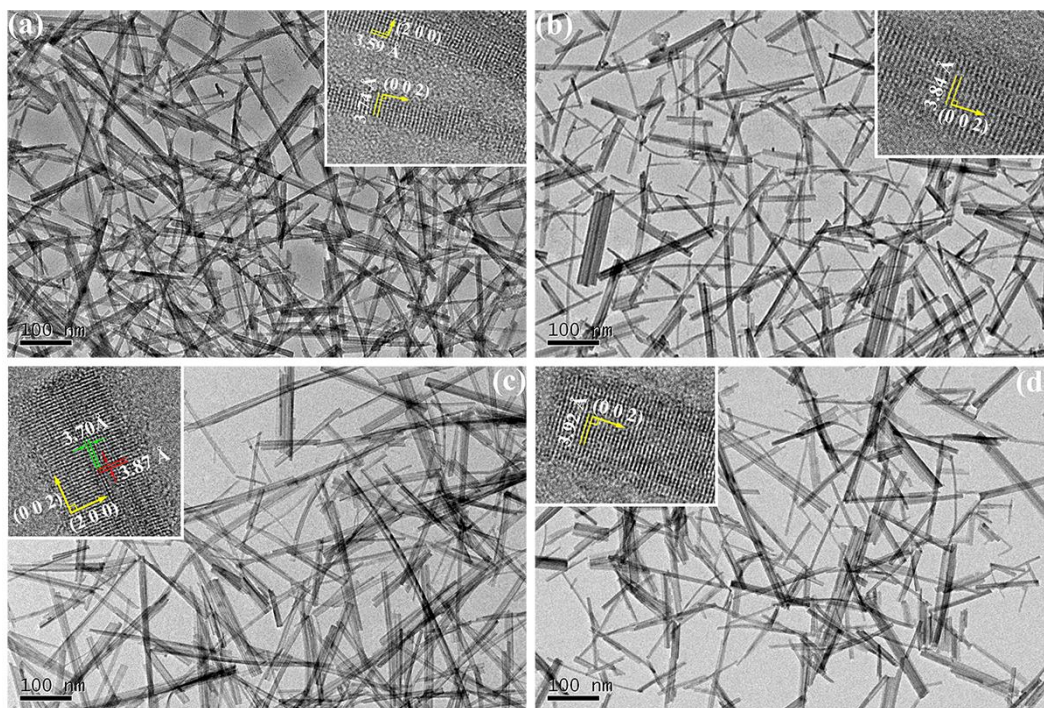


Figure 1. TEM images of (a) WO₃, (b) Li-monodoped WO₃, (c) K-monodoped WO₃ and (d) (Li,K)-codoped WO₃. Inset: HRTEM image of each product.

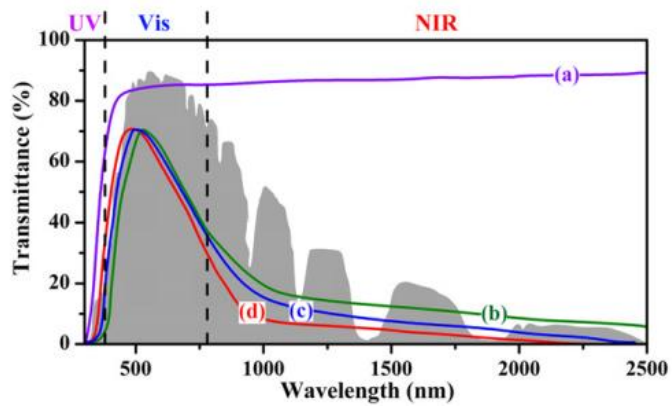


Figure 2. Transmittance spectra of the films containing (a) WO₃, (b) K-monodoped WO₃, (c) Li-monodoped WO₃ and (d) (Li,K)-codoped WO₃.