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The effect of acids precipitants on the synthesis of WO₃ hierarchical nanostructures for highly selective and sensitive H₂S detection

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The detection and monitoring of H₂S gas at high and lower concentrations is very crucial since this gas is highly toxic and can affect tissues and organs, especially in occupational environment. This work reports on the synthesis of WO₃ nanostructures-based sensors for highly sensitive and selective H₂S detection at low operating temperatures. These WO₃ nanostructures were synthesized using pressurized hydrothermal process. Different acids from weak to strong (HNO₃, H₂SO₄, and HCl) were employed as precipitants to form supposedly hierarchical and cube-like nanostructures of WO₃. These WO₃ nanostructures were characterized by XRD, SEM, TEM, XPS and BET analysis. The fabricated WO₃ sensors were exposed to different target gases (CO₂, H₂, CH₄, NH₃, LPG and H₂S) at different concentrations. They were found to be selective to H₂S, and the WO₃ precipitated by HCl otherwise referred to as WO₃-HCl was found to be highly sensitive, with high response of $S = 1394.04$ towards 150 ppm of H₂S at 125°C operating temperature. The WO₃ precipitated by H₂SO₄ named WO₃-H₂SO₄ showed a high response of 141.64 at 125°C operating temperature. Lastly, WO₃ precipitated by HNO₃ called WO₃-HNO₃, recorded a H₂S response of 125.75 also at 125°C operating temperature. The HCl-precipitated WO₃ is a promising candidate for selective detection of H₂S, being the most sensitive in the series.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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