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Effect of Pd sensitization on gas-sensing performance of vanadium pentoxide-reduced graphene oxide composite

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ABSTRACT

Current work clearly demonstrates Pd sensitization on hydrothermally prepared vanadium pentoxide (V_2O_5) and on its composite with reduced graphene oxide (rGO) by a simple dip and dry method for NO_2 gas sensing. Orthorhombic crystal structure of prepared sample was confirmed with the help of X-Ray Diffraction (XRD) technique. The presence of palladium (Pd) was confirmed by energy-dispersive spectroscopy (EDS) and X-Ray photoelectron spectroscopy (XPS), while fourier transform infra-red (FTIR) spectroscopy for functional group detection. Porous nano-structure morphology was confirmed with the help of scanning electron microscopy (SEM). Transmission electron microscopy (TEM) technique confirms presence of Pd nanoparticles (NPs) with an average diameter of ~ 20 nm. The photoluminescence (PL) peak arising at 641.75 nm gives the confirmation to the mid-gap states generated by oxygen vacancies. Finally, the gas-sensing performance of the prepared sensing material was measured with the help of a RIGOL digital multimeter. The result shows that 33.68% gas response towards 100 ppm NO_2 gas at relatively low-working temperature (150 °C) along with considerable 47 and 592 s response/recovery time, respectively. The sensing material shows good reproducibility and high stability (Gas Response ~ 29%) even after 63 days. Hence Pd sensitized V_2O_5-rGO is a promising candidate for gas sensors working at relatively low working temperatures.

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