

Pd decorated TiO₂ nanotube arrays Schottky barrier diodes for efficient hydrogen sensing application

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ABSTRACT

Well aligned TiO₂ nanotube arrays have been synthesized via electrochemical anodization and the Pd decoration was successfully implemented out by electrodeposition with the aid of UV irradiation (Fig.1). A new back to back Schottky barrier diode (SBD) was formed by the connecting of Ag paste-(Pd-TiO₂)-Ti. It was found that such SBDs have excellent hydrogen sensing performances at operating temperature below 80°C and with low detection limit near to 1ppm. Voltage-current curve and electrochemical impedance spectroscopy analysis demonstrated an obvious characteristic of semiconductor diode and showing dramatic capacitance change during the sensing process (Fig.2). This high hydrogen sensitivity of TiO₂ nanotube arrays SBD may be attributed to the synergistic effect of highly ordered nanoporous configurations and the enhancement of hydrogen spill-over with Pd nanoparticle catalyst.

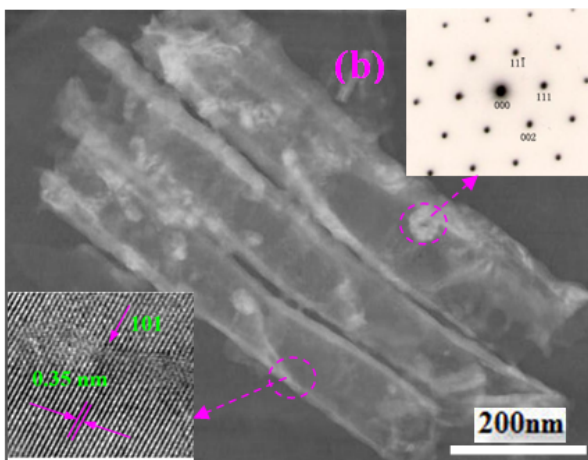
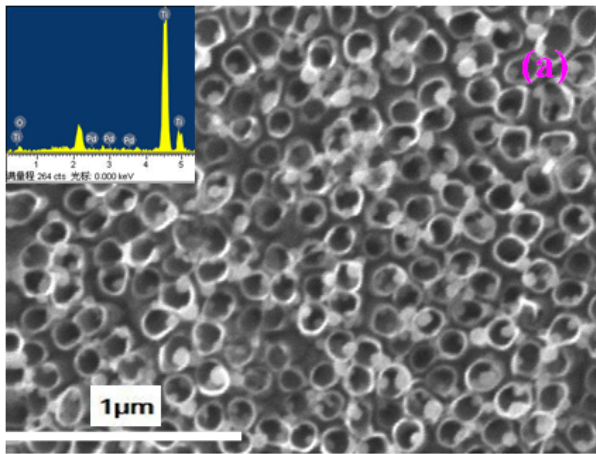


Fig. 1. (a) Images of TiO₂ nanotube arrays with Pd nanoparticles; (b) Typical TEM microstructure of Pd decorated nanotube arrays.

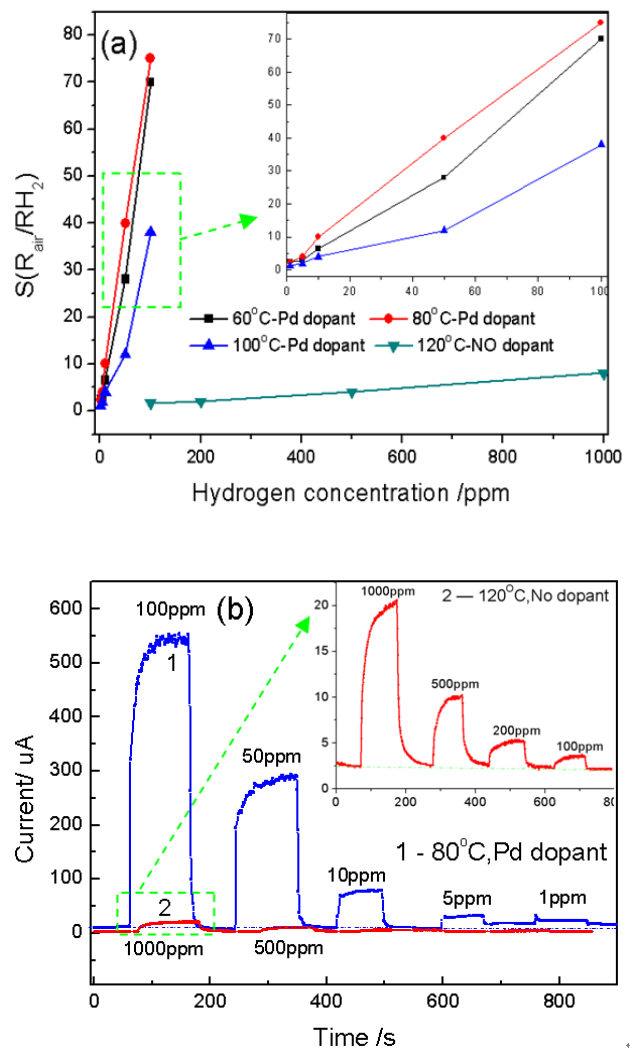


Fig. 2. Resistive response of TiO₂ nanotube arrays with and without Pd embellishment as a function of H₂ concentration (a) and transient response curves upon the introduction and removal of different hydrogen concentrations under a forward bias voltage of 0.025 V(b).

References

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