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Hydrogen sensing with Tin-Oxide thick film sensor

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ABSTRACT

The present study demonstrated the sensing behavior of CdS doped tin-oxide thick film sensor for Hydrogen gas. The Undoped and CdS doped - tin-oxide (1 wt. %, 2 wt. % CdS-SnO_2) sensors are fabricated employing screen- printing technology on alumina substrate. The response characteristic of fabricated sensors has been investigated on variant concentrations (0-5000 ppm) of hydrogen gas at different operating temperatures (423-623 ° K). The measurements reveal that fabricated sensor responds better at lower operating-temperature, 473° K. The doping of CdS considerable enhanced sensor response towards hydrogen and found 42 % for 2 wt. % CdS-SnO_2 sensors. The response and recovery times have been seen to reduce with doping. We conclude that fabricated CdS doped tin-oxide thick film sensor can be evolved as a suitable detector for hydrogen at operating-temperature, 473° K.

Introduction

With the emerging importance in the detection of toxic and inflammable gases, the significance of gas sensing in industrial and domestic applications has been emphasized. Tin oxide (SnO_2) is a most popular sensor material has been widely applied as a basic material due to its high sensitivity and low cast [1-2]. Hydrogen leaks are typically caused by defective seals or gaskets, valve misalignment, or failures of flanges or other equipment. Once released, hydrogen diffuses rapidly. With the gas dispersed in a plume, a detonation can occur if the hydrogen and air mixture is within its explosion range and an appropriate ignition source is available. The recent research is envisaged that hydrogen will form the basic energy infrastructure to power future societies, however if handled hydrogen carelessly, it is dangerous for transport storage and use as in many other fuels. Various metal oxides (TiO_2, SnO_2 etc.) with different approaches have been synthesized to detect hydrogen on variant temperatures with improved sensing response [3-5]. In the present task, screen-printed thick films of tin-oxide with CdS doping have been fabricated for hydrogen detection. The measurements revealed that doping of CdS in tin-oxide enhanced hydrogen response considerably at low operating temperature, 473° K.

Experimental

Tin oxide pastes (doped /undoped) for gas sensing film have been prepared in lab followed by ball mixing process. A layer of tin-oxide (SnO_2) paste has been screen-printed on designed Alumina substrate. Three samples are fabricated named as sensor S_1 (undoped SnO_2), S_2 (1wt. % CdS- SnO_2) and S_3 (2 wt. % CdS- SnO_2), relatively for hydrogen detection.