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Cu-Doping-Level-Controlled Sensitivity and Selectivity of Tin-Oxide-Based Thin Films

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The influence of the Cu-doping level on gas sensitivity and selectivity has been investigated in screen-printed SnO_x films activated by a Pt promoter. It was determined that the resistance response to exposure to H_2 and CO gases depends strongly on the amount of Cu additive at low temperatures ($\leq$150°C). The optimum value of 0.16 wt% for Cu doping was established for a highly sensitive and selective CO gas sensor. The optimum range of the low work temperature (70°C – 100°C) and high stability with respect to variation of temperature through this range have also been obtained.

1. Introduction

Semiconductor gas sensors based on tin oxide or other metal oxides offer very attractive attributes such as high sensitivity, small size, simplicity and low cost. The increasing efforts to adapt these sensors for various areas of industry and domestic uses require well-controlled technology for modification of gas sensing characteristics of metal oxide sensors in accordance with the particular conditions of a specific application. Sometimes the desirable characteristics can be gained by addition of foreign metals, as has been reported by a number of authors.[1-7] It was shown[1-3] that the addition of a small amount of Pd or Pt promotes gas sensitivity and decreases the work temperature. The effect is related to the catalytic activities of noble metals, but sufficient selectivity could not be obtained. On the other hand, a number of authors[3-7] found a variety of additive metals, such as Sb, In, Cu and Bi, effective in producing the selectivity of SnO_x-based elements in response to exposure to certain gases (*e.g.*, H_2, NO_x, H_2S, Cl_2). Since the nature of the effect