

As in handing the practical problem it is

[Design](#), [Architecture](#)



As environmental monitoring constraints imposed federal agencies become stricter, demand for gas sensor with high sensitivities for sensing of various gases are increasing now a days. To meet the demand of low volume gas detection, gas sensors should be enhanced in sensitivity, selectivity, recovery time and response time 1. At the same time they should be cost effective and reliable over long term 2. In Metaloxide semiconductor sensor explore measurement of electric conductivity for sensing the gases of interest. SnO₂ is most widely used material among semi-conductor oxide for making sensors due to its low development cost, long life and good reproducibility 3, 4, thick film SnO₂ device are most studied and most candidate due to their high level of sensitivity, simple design, low weight and cost effectiveness. SnO₂ is an n-type, wide-band gap (3.

6 eV) semiconductor 5. Its electrical conductivity is due to the non-stoichiometric compositions as a result of oxygen deficiency 6. The sensing properties of the thick film gas sensor are based on the adsorption of the gas molecules on its surface which produce changes in their conductivity 7. When gas sensor exposed to atmospheric air, freshly prepared tin-oxide particles adsorb oxygen atoms on the sensor upper layer surface 8. These oxygen atoms pick up the e⁻s from the conduction band of tin oxide and are adsorbed on the particle surface as O⁻ ions. Each tin oxide particle is covered with negatively charged O⁻ ions on the surface. On the other hand, due to depletion e⁻s, there exists a layer of positively charged donor atoms just below the particle surface.

The O⁻ adsorbents react with the gases and release the e⁻s to the conduction band at higher temperature, when reducing gases came in

contact with sensor. Consequently, the depth of the space –charge layer decreases, which result's in a decrease in the height of the potential barrierfor the electronic conduction at the grain boundaries. The concept of ANNanalysis have been discovered nearly 50 years ago, but in handling the practicalproblem it is used only from last 2 –decades9. ANN are collections of smallindividually interconnected processing units. Information is passed between these units along interconnections. An incoming connection has two value associated with it, an input value and aweight.

The output of the unit is a function of the summed value. Once an ANNis trained for a prescribed data it may be ready to be used then for theprediction or classification ANNs can automatically learn to recognize patternin the data real system or from physical models, or other sources. An ANN can handle many input and produceanswer that are suitable for designers in required proper format 10. Artificial Neural Network(ANN) model may be used as alternative method for technological analysis andmatlab based calculation. Artificial Neural Networks have two main components-the processing element called neurons and the connection between them, eachconnection have their own weights. The neurons are the information processorsand the connection functions are the information storage.

Each processingelement first calculates a weighted sum of the input signals and then appliesthe transfer functions . The term ' Feed Propagation' comes due to the trainingmethod used during the training process-back propagation of error. A GradientDescent Backpropagation with adaptive learning rate algorithm is used to adjustthe weights in the hidden and output layer nodes.

The result is a network that produces the mapping between the input values and output values with help of the neurons. In this model perception, Feed-Forward Propagation is one of suitable method of artificial neural network, designed for the testing and training of data.

Training methodologies used in forward propagation are purelin, logsin and tansin network transfer function for all the neurons, which reflects the relationship between concentration as input and sensitivity for different concentration as output of SnO₂ based 1% Pd-doped thick film gas sensor. Sensitivity is tested by artificial neural network. In neural network architecture one layer acts as input layer, ten neurons acts as the hidden layer and other layer output layer.

In this model input is concentration of methanol and output is the sensitivity of sensor. Though in present work single sensor is exposed to single gas or vapor at a time and ANN is utilized to confirm it with experiments so that the data collected can be used to train the network when sensor is replaced by sensor array and single gas is replaced by group of gases or vapors to achieve high selectivity. This model was trained to generate a mapping between the input concentration of the methanol and output as the sensitivity of the methanol. Sensitivity is dimensionless quantity which is obvious from its expression. In the present work feedforward network used to cross verification of gas sensor sensitivity at different temperature & sample concentration after training & testing from practical lab data for the sensitivity of the 1 % Pd-doped SnO₂ sensor. Feed Forward

network uses the Gaussian activation function. The importance of such function is that it is non negative for all value of x .