Seminar

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Institute for Plasma Research

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Title: Studies of the enhancement in the Alcohol vapor sensing capability of Zinc ferrite-based Sensor with Plasma etching and Ion Beam Irradiation

Speaker: Dr. Sanju Rani
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Date: 27th October 2025 (Monday)

Time: 10.00 AM

Venue: Seminar Hall, IPR

Abstract

Air pollution is a major issue that needs to be resolved as a result of the chemical industry's explosive growth[1]. Alcohol is used as a solvent in laboratories, pharmaceutical companies, and industries. Alcohol vapors are harmful to human health and are used extensively in hand sanitizer, paints, printing products, colors, and other items. In presence of alcohol vapor, we experience eye discomfort, lightheadedness, nervous system impairment, and maybe even death [2]. So, we need a vapor sensor, which detect alcohol vapors. Although $ZnFe_2O_4$-based sensors respond well to alcohol vapors, we would like to improve their vapor sensing capabilities by improving their surface characteristics. For a variety of purposes, plasma surface treatment and ion beam irradiation has been widely used to alter the surface properties of materials [3,4].

In this study, we synthesized $Znfe_2O_4$ pallet using combustion method and examined how the performance of zinc ferrite pallet-based alcohol sensor was affected by plasma surface treatment and ion beam irradiation using argon ions. We used RF etching sputtering for the plasma treatment with variable power 50, 100 and 150 W for 15 min. The working and base pressure during experiment was 5×10^{-2} and 5×10^{-5} mbar. During Ion beam irradiation, we irradiate the samples on different energies 200 and 300 eV for 15 min. The base and working pressure during experiment was 2.5×10^{-7} and 2.25×10^{-4} mbar with 0° incident angle. To characterize the samples, we used XRD, Raman Spectroscopy, SEM, and XPS respectively.

The plasma-treated on $ZnFe_2O_4$ pallets has shown a high response (Cg/Ca) of 51.5 to 1000 ppm butanol and a response/recovery time of 332 s/1230 s at 300°C, respectively. Also, after ion beam irradiation, it has the response 45.6 towards 1000 ppm butanol with 234/1148s response and recovery time at 300°C. The mechanism by which the as-fabricated sensor's sensing properties have been improved are discussed.

Keywords

$ZnFe_2O_4$; Plasma Treatment; Surface Morphology; Vapor Sensor; Sensing Mechanism

References:

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