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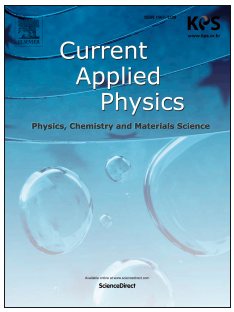

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Elucidating iron doping induced n- to p- characteristics of Strontium titanate based ethanol sensors

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ABSTRACT

A series of pure and iron doped strontium titanate, ($SrFe_xTi_{1-x}O_3$; x = 0, 0.1 and 0.2) powders were synthesized, characterized and used to fabricate ethanol sensors for low concentration. X-Ray Diffraction (XRD) technique was used to confirm the single phase formation. Microstructural properties of the powders were investigated using scanning electron microscopy (SEM). Electrical conductivity of all the samples at room temperature (RT) was measured. Sensors were optimized for best responsiveness by varying the operating temperature from 350^{o}C- 500^{o}C.The sensor with doping x = 0.2 exhibited best sensing response at 400^{o}C for ethanol gas. The undoped sensor demonstrated a decrease in resistance on exposure to ethanol gas whereas Fe-doped sensors showed increase in resistance. The doping induced changeover from n to p behavior in the sensing response on doping has been investigated and corroborated with an observed shift in the Fermi level position by X-ray photoelectron spectroscopy (XPS). The disparity in gas sensing response clearly demonstrates inter-connection of multiple influencing factors such as electrical conductivity, morphology, porosity and change in chemical composition on doping. The sensors were exposed to ethanol, nitrogen dioxide, carbon monoxide, butane gases at concentration between 5 ppm to 50ppm. The sensor exhibited much reduced relative response to all gases other than ethanol which can be utilized for wide range of applications.

Keywords: Strontium titanate, doping, ethanol sensing, n- and p- type gas sensors, XPS.
