# EFFECT OF SUBSTITUTION OF Pr AT Eu-SITE ON OXYGEN SENSING PROPERTIES OF $Eu_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ RODS WITH HOT SPOT

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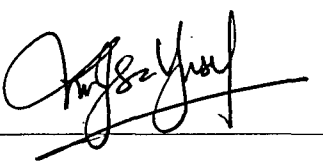
This Final Year Project entitled "**Effect of substitution of Pr at Eu-site on Oxygen Sensing Properties of $Eu_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ Rods with Hot Spot**" was submitted by 'Aizzuddeen Bin Mustafa, in partial fulfilment of the requirements for the Degree of Bachelor Science (Hons.) Physics, in the Faculty of Applied Sciences, and was approved by



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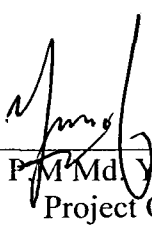

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## ABSTRACT

### EFFECT OF SUBSTITUTION OF Pr AT Eu-SITE ON OXYGEN SENSING PROPERTIES OF $Eu_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ RODS WITH HOT SPOT.

A hot spot is a phenomenon where a localized part of a rod made from compound of RE123 system glows when the applied voltage exceeded the threshold voltage of the rod. Upon the appearance of the hot spot, the output current is dependent on the oxygen concentrations of the environment hence making it a suitable candidate as an oxygen sensor. In this project, the effect of Pr substitution at the Eu-site of $Eu_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ rods on oxygen sensing properties were studied. The $Eu_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ ( $x = 0.00 - 0.25$) ceramic samples were synthesized using conventional solid state method. The mass of each powder were exactly weighed by using the stoichiometric ratio followed by mixing and grindings. The powders were then calcined and press into pellets before they were sintered. The samples were cut into rods to the exact dimensions of 12 mm x 1.48 mm x 1.48 mm. XRD analysis showed that, the samples did not undergo any structural changes but the orthorhombicity of the samples are decreasing which indicate that the sample is in the phase of changing their structure to tetragonal. Generally, the output current decreased abruptly for samples $x = 0 - 0.10$ after appearance of hot spot. However, for $x$ = 0.15-0.25, the output current almost reached to the constant plateau after the appearance of hot spot. In addition, all samples showed a great sensitivity at lower oxygen concentration but became less sensitive at high oxygen concentration. From this result, it is suggested that the higher Pr substitution ( $x$ = 0.25) showed an excellent sensitivity. As the oxygen concentration is varied from 20% to 100% and vice versa, samples with low Pr substitution ( $x$ = 0 - 0.10) showed better reproducibility. The longer respond time of the output current with respect to changing oxygen concentration prevents the higher Pr substitution samples from getting a favourable reproducibility.

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