FABRICATION OF NITROGEN DETECTOR FROM POROUS SILICON NANOSTRUCTURES

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ABSTRACT

Nowadays, nanoscience there is an increasing demand for low-dimensional and nanostructure systems. Silicon is the most dominant material used in semiconductor technology but bulk silicon is not taken into consideration to used. Porous silicon is a potential candidate for various applications to fabricate miniaturized and cheap devices. The high surface area of this material such as porous silicon nanostructures makes it is widely used in fields of optics, detector technology and biomedicine. One of the main application areas of porous silicon is detector technology. In this study, the nitrogen detector is fabricated to determine the leakage of this gas where it can give harmful to people, animals and plants.

In this study the porous silicon nanostructure is fabricated by using anodization method because of simple and easy to handle. This method using HF 48% and the ethanol in etching process to etch the silicon bulk to be porous silicon with 20 mA/ cm^2 of current density and the etching time is from 10 minutes - 40 minutes. The properties of the porous silicon nanostructure analyzed using I-V testing (electrical properties) and photoluminescence spectroscopy (optical properties). From the I-V testing, I-V graph obtained to analyze the sensitivity of the detection of the nitrogen gas and from the testing gained that the most sensitive sample to detect the existence of N_2 is sample PsiE40 where the sensitivity is 75 % for nitrogen flow rate at 2 bubbles per second in 10 seconds. 25.4% is a sensitivity of PSiE40 at 10 seconds exposure time where the flow rate is 5 bubbles per seconds 29.9% is sensitivity of the PSiE40 at 50 seconds exposure time with 5 bubbles per seconds as a reading of the gas flow rate.

For photoluminescence (PL), the PL spectrum is analyzed based on the intensity and wavelength of the spectrum to determine the pore size of the structure and to determine the energy band gap of the material. From the analysis, the result show that the PL wavelength is blue shift and sample PsiE20 got higher intensity compared to the others where the reading is 62.945444 a.u.