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作品編號	160035
參展科別	物理與天文學
作品名稱	<b>GAS SENSOR APPLICATIONS WITH PHOTONIC CRYSTAL FIBER AND CARBON DIOXIDE SENSOR DESIGN</b>
得獎獎項	二等獎
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## ABSTRACT

It's very important to control and monitor gases that are produced by industrial applications in different values and kinds because they can cause environmental pollution and health problems. Photonic Crystal Fiber (PCF), which is a different kind of optical fiber, is a new alternative for gas sensors due to their small sample volumes, low transmission losses and high flexibility properties. PCF's are silica-glass fibers, made by periodic sequence of hollows along the fiber. By filling these hollows with optical liquids or gases very sensitive sensors can be made.

In this project, we aimed to design a sensitive sensor by filling the hollows with proper gases and liquids in the solid core PCF. For these applications ethanol, methanol, toluene vapors and carbon dioxide was used. And to observe carbon dioxide's effects ionic liquid (EMIMBF<sub>4</sub>), which carbon dioxide can dissolve in, was filled then the experiments were repeated.

It was observed that the transmission of light in PCF changed depending on the refractive index of the gas that was filled. With this change, it was understood that there were another gas besides the usual containments of air. Our system could measure the absorption peak of toluene so it can be used as a toluene detector and when ionic liquid filled the fiber, two steps that occur in the spectra of carbon dioxide so it can also be used as a carbon dioxide detector. The system was customized as a carbon dioxide sensor in a cost-efficient and portable way.

Our system can be specialized and easily used with right light source, which is efficient to see the absorption peaks, and proper liquids to detect intended gas.

Making a carbon dioxide sensor by filling PCF with ionic liquid was never attempted before. Also the lack of carbon dioxide sensor studies supports the originality of our project. That's why we think our project will contribute very importancies to the existing literature.

## 【評語】 160035

An innovative research project about photonic-crystal fiber (PCF) gas detector. The hollows in PCF were filled with to dissolve Carbon dioxide and alter the index and absorption spectrum.

The experiments were well prepared. The optical spectrum demonstrate the sensitivity of carbon dioxide.