Gas sensing characteristics of coreless optical fiber based NO gas sensor

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In recent years, the exhaust gas concentration regulation became an important issue throughout the world because of the global warming, acid rain, and photochemical smog due to the exhaust gases such as NO\textsubscript{x} and CO\textsubscript{2}. Especially, NO\textsubscript{x} gas sensor using optical fiber attracted much attention because it’s advantage in using at high temperature and chemically extreme environment. We have fabricated specially designed optical fiber coated with low-index polymer (n=1.4), which does not have any dopant in the fiber core to prevent diffusion at high temperature. By using the coreless specialty optical fiber coated with low-index polymer, gas sensing characteristics were investigated through the interaction with NO\textsubscript{x} gas on the surface of the optical fiber.

We demonstrated a coreless optical fiber NO gas sensor based on interaction of light signal with the fiber surface. The absorption from 600 nm to 900 nm was found to be due to NO gas through the evanescent field of the guided mode. When the NO gas concentration increased, the absorption intensity increased and the response time decreased. The absorption with the NO gas concentration of 1,500 ppm and 5,000 ppm were about 2.1 dB and 7.5 dB at 800 nm upon pumping with the 977 nm LD at 250 mW, respectively. The response time with the NO gas concentration of 1,500 ppm and 5,000 ppm were less than 8.8 sec at 670 nm and 0.8 sec at 606 nm, respectively.