

# MEMS Hydrogen Gas Sensor for the Entire Concentration Range of Hydrogen Gas

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We have proposed a new type of hydrogen gas sensor that is a combination of two types of hydrogen sensor, in which one is for a lower hydrogen gas concentration of less than 4% and the other is for a higher hydrogen gas concentration of more than 4%. The hydrogen gas sensor for low concentration works basically at room temperature based on the exothermic reaction of a Pd film formed on the cantilever and that for high concentration works during heating to about 150°C as a thermal conductance-type sensor by using the high thermal conductivity of hydrogen gas. This hydrogen gas sensor with a cantilever as a sensing area is fabricated using micro-electromechanical systems (MEMS) technology and silicon-on-insulator (SOI) substrate. A nichrome (NiCr) microheater and three thin-film thermocouples composed of an SOI layer of heavily doped n-type impurity and a Ni film layer are formed on the cantilever, and two areas, namely, a sensing area (region B<sub>S</sub>) with the Pd film and a reference area (region B<sub>R</sub>) without the Pd film, are formed with the same size in the vicinity of the tip of the cantilever. We have demonstrated that the proposed hydrogen gas sensor can measure hydrogen concentration at a very wide range from 0.1 to 100% within about 10 s.

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