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Noninvasive Optical Transcutaneous pCO_2 Gas Sensor

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This paper presents an optical transcutaneous pCO_2 gas sensor and analyzer using a noninvasive method. The basic principle of the pCO_2 measurement method adapts Beer-Lambert's law and the embodied system uses the nondispersive Infrared (NDIR) method. Since CO_2 gas reacts to a 4.3 μm wavelength, this wavelength is selected using an optical filter, and used energy decrease by molecule oscillations. The CO_2 concentration is then measured by a mass flow controller (MFC) using basic steps, instead of collecting pCO_2 gas by inflicting heat on the outer skin. The measuring system consists of an IR lamp, optical filter, optical reaction chamber, pyroelectric sensor, and a signal processing part. To make the sensor system portable, the length of the optical reaction chamber is minimized to 1 mm using a Si wafer based on MEMS technology. When CO_2 gas is injected into the optical reaction chamber, a result of 4.3 mV was confirmed when using a photoreaction path of 1 mm with a CO_2 gas reaction. The response time of the system was within 2 s, which we consider to be relatively rapid.

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