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# Characteristics of Transcutaneous $pCO_2$ Gas Sensor Based on LiF Glass Using Soft Lithography

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In this study, we developed a noninvasive optical transcutaneous partial pressure of carbon dioxide, $pCO_2$, monitoring system by nondispersive infrared, NDIR. The objective of this system is to detect $CO_2$ from the outer skin and not by an arterial blood-sampling method. There are several advantages of this system, such as short analysis time and potential for real-time monitoring. This measurement system is composed of an IR lamp, a pyroelectric sensor including a 4.26 μm optical filter, an optical gas reaction chamber, and a signal processing circuit. The pass length of the optical reaction chamber is fixed at 1 mm by soft lithography because we considered that $CO_2$ gas is released from the human body. The fabricated $pCO_2$ monitoring system shows a sensitivity of $6.50\times 10^{-6}$ absorbance/ppm in an arterial-blood $CO_2$ concentration region of 0 to 5,000 ppm, is controlled using a mass flow controller (MFC), and has very fast response characteristics. We consider that this proposed system can be used in the optical-biosensor field for medical diagnosis, such as a $pCO_2$ monitoring system, a capnograph system for $EtCO_2$ analysis, and for environmental monitoring systems.

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