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Fabrication and characterization of MoS_2 chemiresistor for pH sensing FENG ZHAO, ALLEN LIM, ZECONG FANG, School of Engineering and Computer Science, Washington State University Vancouver — Chemical and biological sensing is critical in medical diagnosis, environmental monitoring, etc. As a semiconductor with a bandgap energy and naturally 2D layered atomically thin structure, molybdenum disulfide (MoS_2) has potential to provide ultrahigh sensitivity and its planar nature is preferred for monolithic integration. In this paper, we report the fabrication and characterization of a simple gate-free MoS_2 sensor device configured as a planar chemiresistor for pH sensing. MoS_2 crystals from monolayer to multiple layers were prepared by widely used mechanical exfoliation technique, and transferred onto a Si chip with a 300 nm SiO_2 layer. A mask-free fabrication process was applied to manufacture the chemiresistors with contact electrodes. With a constant bias voltage, the real-time currents following through the chemiresistors were recorded when drops of pH buffer solution in the pH range from 3 to 10 were placed on the crystal surface. The currents increase with a response time less than 2 seconds. The resistances decrease linearly with the increase of pH values, with a high sensitivity ($\Delta\Omega$/pH) derived. The repeatability, hysteresis and long-term stability of the chemiresistors were also investigated. The simple mask-free fabrication, fast response time, high sensitivity and other properties altogether prove that MoS_2 is a very promising sensor material.

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