第726回　化学・物質工学セミナー 開催のお知らせ

Growth and Gas Sensing Properties of CVD Grown 2D Materials

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日時：令和4年9月22日（木）14:30～16:00
場所：総合教育研究棟3階　大講義室

日本学術振興会の外国人研究者招へい（短期）事業で、機能材料化学研究室で国際共同研究を遂行中のMahesh Kumar准教授の下記の内容の研究成果についてご講演いただきます。多くの皆さまのご参加をお待ちしています。

Abstract
The concentration of hazardous and toxic gases rapidly increases in environment due to continuous advancement in industrialization. Chemiresistive sensors are simple and easy to integrate with IoT platforms. However, metal oxide based chemiresistive sensors are operating at high temperature and their performance is affected by the environmental factors. Synthesis of a suitable material for the targeted gas is a challenge and 2D materials may play a major role. The profusion of 2D materials has provided a broad material platform for technological research and the growth of nano- and atomic-level applications. The invention of graphene has sparked interest in other unique 2D materials, a process known as modern-day "alchemy," in which scientists attempt to transform all conceivable periodic table components into 2D material structures and shapes. Industrial applications for 2D material devices with excellent quality and outstanding optical encoder performance are numerous including sensors. 2D metal dichalcogenides including MoS_2, WS_2, SnS_2, etc., have received significant attention from the worldwide scientists for a variety of novel applications owing to their unique electronic, chemical, optical, and physical properties. We have grown various nanostructures of MoS_2 including nanowire networks for high-performance NO_2 sensors. Chemical transport reactions and regulated turbulent vapour flow were used to create the MoS_2 nanowire network. The sensing behaviour of the nanowires was investigated at different temperatures for various concentrations of NO_2 and the sensor exhibited about 2-fold enhanced sensitivity with a low detection limit a few ppb for NO_2 at 60 °C compared to sensitivity at room temperature. Using a kinetically controlled fast growth CVD technique, we created horizontally and vertically aligned MoS_2 flakes on a SiO_2/Si substrate. At ambient temperature, the vertically aligned MoS_2 gas sensor had a two-fold greater sensitivity to NO_2 than horizontally oriented MoS_2. We demonstrate a highly selective and sensitive NO_2 gas sensor using vertically aligned 2D SnS_2 flakes, grown by a chemical vapor deposition method in controlled gas flow. The sensor exhibits high gas sensing response (ΔR/R%) of ~164 at 120 °C with 50 ppm of NO_2 gas. The talk will also focus on various methods of improving the sensitivity and selectivity of the sensor.

コロナウイルス感染対策および事前登録について

長崎大学の感染対策にご協力をお願いします。なお、感染拡大予防のため、事前参加登録制とします。下記の登録フォームより、9月16日（金）までに登録をお願いします。

事前参加登録フォーム：　https://forms.gle/a22h6th9vq7ETV6R8

学内外の感染状況によっては、完全オンラインで実施する場合もあります。その場合には、メールでZoomのURLをお知らせしますので、ご了承願います。

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