Frontier Chemistry Center 講演会
フロンティア化学教育研究センター

演 題 : **2D Materials: From Development of Novel Growth Methods Towards Its Multifunctional Applications**

講 師 : **Prof. Yu-Lun Chueh**

National Tsing Hua University, Taiwan

日 時 : 2018 年 7 月 20 日（金）14:45~16:15

場 所 : フロンティア応用科学研究棟 セミナー室 1

要旨 : 2D materials have attracted much attention because of frontier electronic materials due to its superior electronic transport properties and mechanical flexibility in the future, making it a potential material for high performance and wearable electronics. Graphene is a typical 2D materials with high carrier mobility; however, it still cannot be applied in transistor due to the lack of bandgap. A new type of 2D semiconducting materials called transition metal dichalcogenides (TMDCs), which are layered structure with the strong in-plane bonding and weak out-of-plane interactions similar to graphite, have been intensively studied. Recent studies have predicted exceptional physical properties upon reduced dimensionality attracting lots of attention due to the versatile physical chemical behaviors. Nevertheless, the synthesis and the study of the fundamental physical properties of TMDs are still in early stages. The lack of a large-area and reliable synthesis method restrict exploring all the potential applications of the TMDs. Chemical vapor deposition (CVD) is a traditional approach for the growth of TMDs; nevertheless, the high growth temperature is a major drawback for its to be applied in flexible electronics. In this talk, an inductively coupled plasma (ICP) was used to synthesize Transition Metal Dichalcogenides (TMDs) through a plasma-assisted selenization process of metal oxide (MO_x) at a low temperature, as low as 250 °C. Compared to other CVD processes the use of ICP facilitates the decomposition of the precursors at lower temperatures; therefore, the temperature required for the formation of TMDs can be drastically reduced. WSe_2 was chosen as a model material system due to its technological importance as a p-type inorganic semiconductor with an excellent hole mobility. Large-area synthesis of WSe_2 on polyimide (30 x 40 cm^2) flexible substrates and 8-inch silicon wafers with good uniformity was demonstrated at the formation temperature of 250 °C as confirmed by Raman and X-ray Photoelectron (XPS) spectroscopy. Furthermore, by controlling different H_2/N_2 ratios, hybrid WO_x/WSe_2 films can be formed at the formation temperature of 250 ºC as shown by TEM and confirmed by XPS. The applications o including (1) water splitting, (2) gas sensors, (3) photodetectors, (3) anode materials in secondary ion battery will be reported.

本講演は、大学院総合化学院『化学研究先端講義（修士課程選択科目）／
総合化学特別研究第二（博士後期課程選択科目）』の一部として認定されています。

連絡先：工学研究院応用化学部門　島田　敏宏（内線：6576）

フロンティア化学教育研究センター