Synthesis of MoS_2 by Plasma Enhanced Atomic Layer Deposition for Gas Sensor

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Transition metaldichalcogenides (TMDCs) are introduced as layered materials which haveattracted great attention as sensing materials with high sensitivity, due to theirlarge surface-to-volume ratios and semiconducting properties. Unlike metaloxide sensors, the TMDCs based sensor shows tremendous sensitivity at roomtemperature that overcomes the limitation of metal oxide gas sensor. Therefore,synthesis of atomically thin MoS_2 with layer controllability andwafer-scale uniformity is essential for their applications in gas sensor. AtomicLayer Deposition (ALD) is known to be process based on the self-limitingcharacteristic for growth of large-area thickness uniform. In this regard, ALDcan be effective method for the synthesis of MoS_2 with layer controllabilityfor gas sensor.

Inthis work, MoS_2 is achieved on SiO_2 substrate by PEALDprocess with $Mo(CO)_6$ as precursor and H_2S as reactant. Wehave evaluated growth characteristics of MoS_2 and the results showthat the number of MoS_2 film layers can be controlled by the numberof ALD cycles. The synthesized MoS_2 are evaluated using spectroscopic(Raman, XPS) and microscopic analysis (SEM). Furthermore, we demonstrate therealization of MoS_2 gas sensor and evaluating its characteristics atroom temperature. This fabrication process could provide an opportunity for theproduction of burgeoning the TMDCs synthesis and various nanodevices.