
Layer-by-layer oxidation of MoS₂ using oxygen plasma treatment

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After graphene has emerged as future materials, other two-dimensional(2D) materials such as hBN, BP, MoS₂ and WSe₂ have been studied. Among (semi-)metallic, insulating and semiconducting 2D building blocks, transition metal dichalcogenide (TMD) materials have attracted many attention due to their unique properties. 2D semiconductors are promising materials for future device owing to their superior properties such as high mobilities, transparency, and flexibility. TMDs have different band structure depending on the number of layers. The most representative change of band structure of TMD is indirect- to direct bandgap transition depending on bulk to monolayer. Because of these properties, the control of the number of layer is very important issue for the optical and electrical properties of them. In this research, our customized O₂ plasma system is used to either thin down or oxidize the layer to acquire monolayer MoS₂. Especially with oxidation mode, the top layer of MoS₂ was oxidized to MoO_x leaving the bottom layer intact, resulting in the high photoluminescence intensity corresponding to that of monolayer MoS₂. Our work provides an effective way for the formation of monolayer MoS₂ from a multilayer flake, which is essential for fundamental studies and engineering of 2D materials.