

Etching-free transfer of wafer-scale MoS₂ films

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Abstract

Two dimensional MX₂ (MoS₂, WS₂, etc.) materials have sparked wide interest in both basic and applied researches, such as optoelectronics, valleytronics, and hydrogen evolution reactions, etc. To realize the usage of MX₂ in real applications, transfer of as-grown materials from the commonly used insulating substrates onto target substrates is an essential step. However, traditional wet chemical etching method cannot avoid the use of substrate etchants such as HF, which usually cause the degradation of film quality, the destruction and waste of substrates, as well as potentially environmental issues.

Herein, we develop an etching-free transfer method for transferring wafer-scale MoS₂ films onto arbitrary substrates by using ultrasonication. Briefly, the collapse of ultrasonication-generated microbubbles at the interface between polymer-coated MoS₂ film and substrates induce sufficient force to delaminate the MoS₂ films. Using this method the MoS₂ films can be transferred from all the substrates (silica, mica, strontium titanate, sapphire) and remains the original sample morphology and quality. This method guarantees a simple transfer process, allows the reuse of growth substrates, without the presence of any hazardous etchants. The etching-free transfer method may promote the broad applications of MoS₂ in electronics, optoelectronics and catalysis.

References

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Figures

