Grain Boundaries in CVD-Grown Monolayer Transition Metal Dichalcogenides

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Abstract

Two-dimensional monolayer transition metal dichalcogenides (TMdCs), driven by graphene science, revisit optical and electronic properties, which are markedly different from bulk characteristics. These properties are easily modified due to accessibility of all the atoms viable to ambient gases, and therefore there is no guarantee that impurities and defects such as vacancies, grain boundaries, and wrinkles behave as those of ideal bulk. On the other hand, this could be advantageous in engineering such defects. Here, we report a method of observing grain boundary distribution of monolayer TMdCs by a selective oxidation. This was implemented by exposing directly the TMdC layer grown on sapphire without transfer to ultraviolet light irradiation under moisture-rich conditions. The generated oxygen and hydroxyl radicals selectively functionalized defective grain boundaries in TMdCs to provoke morphological changes at the boundary, where the grain boundary distribution was observed by atomic force microscopy and scanning electron microscopy. This paves the way towards the investigation of transport properties engineered by defects and grain boundaries.

References

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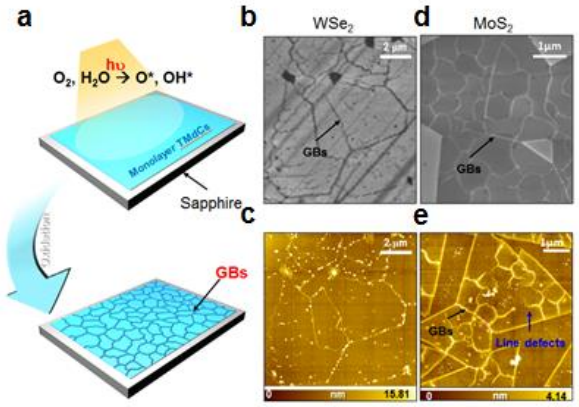
[2] Huang, J.-K. *et al.* Large-Area Synthesis of Highly Crystalline WSe_2 Monolayers and Device Applications. *ACS Nano* **8** (2014), 923–930.

[3] Ly, T. H. *et al.* Observing Grain Boundaries in CVD-Grown Monolayer Transition Metal Dichalcogenides. *ACS Nano* **8** (2014), 11401–11408.

Figures



(a) Schematic of the ultraviolet irradiation process. (b,c) SEM and AFM image of oxidized WSe_2. (d,e) SEM and AFM image of oxidized MoS_2.