Tungsten Diselenide(WSe_2) Biosensor Field Effect Transistor(BioFET) woth A High Sensitivity.

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In recent years, the demand for highly sensitive and reusable biosensors has increased since the applications based on biosensors have become diverse,with the range including medical, agricultural, industrial, and environmental fields. Thus, various types of biosensors such as electrochemical biosensors,optical biosensors, piezoelectric biosensors, and electrical biosensors have been proposed. Particularly, biosensors based on the field-effect transistor(FET) structure (Bio-FET) have attracted great interest due to its i) high sensitivity, ii) label-free detection, iii) fast detection speed, and iv) miniaturization.For reference, the sensitivity of the BioFETs is strongly dependent on the thickness. Very recently, transition metal dichalcogenides (TMDs), such as graphene, molybdenum disulfide (MoS_2), and tungsten diselenide (WSe_2),have been studied, because these materials have a layered structure based on the van der Waals (vdW) interaction, which induces a high sensitivity.

In this work, we demonstrate a highly sensitive and reusable membranelesstungsten diselenide (WSe_2) BioFET. The almost non-existent defectson the WSe_2 surface without dangling bonds allow for the highlysensitive operation of the membraneless WSe_2-BioFETs, unaffected bythe non-specific binding. We generate only small amounts of defects that serveas binding sites for bioreceptors on the defect-free WSe_2 surfacethrough weak oxygen (O_2) plasma, thereby maximizing the sensitivityof the WSe_2 BioFET.