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Effect of oxidation of vanadium diselenides (VSe2) thin film on water adsorption properties under ambient water vapor condition

Content

Vanadium diselenide (VSe2), a member of metallic transition metal dichalcogenides, has attracted a lot of attention as a potential 2D layered material for water splitting and hydrogen production applications. Understanding the interaction at heterogeneous interface between surface and water is crucial for improving the efficiency of water splitting. However, fundamental understanding during electrochemical or electrocatalytic reactions at the interface have not yet been established because surface analysis methods, such as XPS, STM and TEM, are often conducted at ultra-high vacuum condition which differ from the actual reaction circumstances. Near ambient pressure X-ray photoemission spectroscopy (APXPS) enables the investigation of chemical bonding characteristics of the solid surfaces exposed with diverse gas environments, such as water vapor, up to a few millibars, which is similar to electrochemical or electrocatalytic reaction condition. Here, we will present the effect of VSe2 thin film oxidation on water adsorption properties as measured by APXPS under water vapor conditions. Rather than the V-Se bonding property, the V-O bonding property plays a significant role in enhancing the water adsorption characteristic. Our results can help to understand heterogeneous catalytic properties. Our results can provide reference points for water adsorption characteristics in relation to oxidation states of VSe2 thin film, as well as insights into a way to treat surface for development of water splitting performance.

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