**TT-P047**

**In-situ Growth of Epitaxial PbVO3 Thin Films under Reduction Atmosphere**

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PbVO\(_3\) (PVO), a polar magnetic material considered as a candidate of multiferroic, has ferroelectricity along the c-axis and 2-dimensional antiferromagnetism lying in the in-plane through epitaxial growth \([1,2]\). PVO thin films were grown on LaAlO\(_3\) (001) substrates under reduction atmosphere from a stable Pb\(_2\)V\(_2\)O\(_7\) sintered target using pulsed laser deposition method. Epitaxial growth of the PVO films is possible only under Ar atmospheren with no oxygen partial pressure. X-ray diffraction was used to investigate the phase formation and texture of the films. We confirmed epitaxial growth of the PVO films with crystalline relationship of PbVO\(_3\)[001]//LaAlO\(_3\)[001] and PbVO\(_3\)[100]//LaAlO\(_3\)[100]. In addition, surface morphology of the films displays drastic changes in accordance with the growth conditions. Elongated PVO grains are related to the Pb\(_2\)V\(_2\)O\(_7\) pyrochlore structure. The relation between structural deformation and ferroelectricity in the PVO films was examined by local measurement of piezoresponse force microscopy.

**References**


**Keywords:** reduction atmosphere, pulsed laser deposition, lead vanadate

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**Synthesis and Characterization of Large-Area and Highly Crystalline Tungsten Disulphide (WS\(_2\)) Atomic Layer by Chemical VaporDeposition**

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Translation metal dichalcogenides (MoS\(_2\), WS\(_2\), WSe\(_2\), MoSe\(_2\), NbS\(_2\), NbSe\(_2\), etc.) are layered materials that can exhibit semiconducting, metallic and even superconducting behavior. In the bulk form, the semiconducting phases (MoS\(_2\), WS\(_2\), WSe\(_2\), MoSe\(_2\)) have an indirect band gap. Recently, these layered systems have attracted a great deal of attention mainly due to their complementary electronic properties when compared to other two-dimensional materials, such as graphene (a semimetal) and boron nitride (an insulator). However, these bulk properties could be significantly modified when the system becomes mono-layered; the indirect band gap becomes direct. Such changes in the band structure when reducing the thickness of a WS\(_2\) film have important implications for the development of novel applications, such as valleytronics. In this work, we report for the controlled synthesis of large-area (~cm\(^2\)) single-, bi-, and few-layer WS\(_2\) using a two-step process. WO\(_x\) thin films were deposited onto a Si/SiO\(_2\) substrate, and these films were then sulfurized under vacuum in a second step occurring at high temperatures (750°C). Furthermore, we have developed an efficient route to transfer these WS\(_2\) films onto different substrates, using concentrated HF. WS\(_2\) films of different thicknesses have been analyzed by optical microscopy, Raman spectroscopy, and high-resolution transmission electron microscopy.

**Keywords:** Transition metal dichalcogenides, WS\(_2\)