Raman fingerprints for thickness and crystallographic orientation of WTe_2

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Abstract

Tungsten ditelluride (WTe_2) is a layered transition-metal dichalcogenide material with distorted orthorhombic structure and has attracted interest due to large, non-saturating magnetoresistance (MR) [1]. WTe_2 shows significantly anisotropic MR behavior, which is maximum when the magnetic field is parallel to the c-axis and the current is parallel to the a-axis (zig-zag) [2]. The difference between the two Raman peaks positioned at ~ 160 and ~ 210 cm^{-1} has been studied as an indicator of the thickness of WTe_2 [3]. However, because the Raman peak near ~ 210 cm^{-1} contains two separate Raman peaks with strong incident polarization dependence, the measured peak position difference is not reliable. In this work, we investigated Raman fingerprints for crystallographic orientation and thickness of WTe_2. We measured polarized Raman spectra of WTe_2 in vacuum because WTe_2 shows strong dependence of incident laser polarization and could be degraded in air. We found new Raman peaks at ~ 80 and ~ 90 cm^{-1} which depend on the thickness of WTe_2. Also, we established the relationship between the crystallographic orientation of WTe_2 and the polarization dependence of the Raman spectra by comparing with TEM data. Precise determination of the thickness is important in designing a device based on WTe_2.

References

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Figure

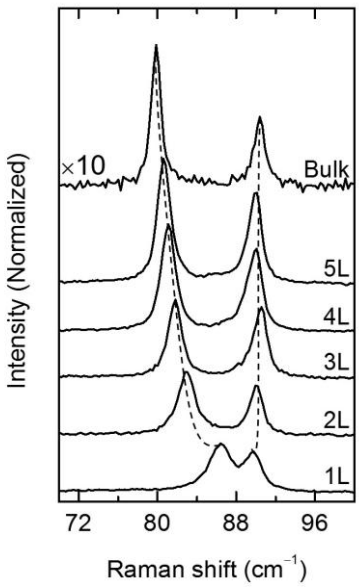

Figure 1 Raman spectra as a function of thickness of WTe_2 with excitation energy of 1.96 eV