

Atomic Defects and Quantum Light Sources in van der Waals α -MoO₃

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Atomic defects in solid-state materials have attracted much recent attention due to their potential to realize photonic quantum information processing in various material platforms. Quantum light sources from atomic defects in two-dimensional (2D) materials have been particularly promising for developing quantum technologies in van der Waals (vdW) materials and heterostructures. However, studies on room-temperature (RT) quantum emitters in 2D materials have been limited so far, urging the identification of novel 2D materials that can host RT quantum emitters to enable a wider range of fundamental studies and quantum applications. In this talk, we present the observation of RT quantum emission from α -MoO₃, a vdW semiconductor which has a bandgap of 3 eV [1]. By annealing exfoliated ultrathin α -MoO₃ flakes, we found localized sharp emitter peaks around the energy of 2 eV. With the photon antibunching curve in the second-order correlation function measurements, single-photon nature of the emitted light is demonstrated. The density functional theory calculation further supports that the oxygen vacancy center is a highly promising candidate of the observed emitters. Our work provides α -MoO₃ as a novel platform to study atomic defects and quantum light sources in vdW systems for realizing RT quantum technologies.

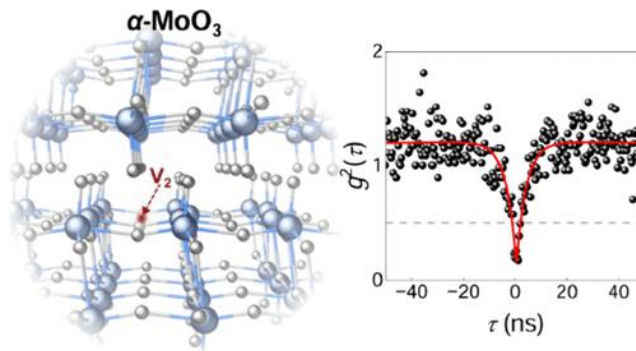


Figure 1 Atomic defect structure of α -MoO₃ and second-order correlation function.

[1] J. Lee, H. Wang, K.-Y. Park, S. Huh, D. Kim, M. Yu, C. Kim, K. S. Thygesen, J. Lee, Nano Lett. **25**, 1142 (2025).

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