
Quantum materials boost quantum technology

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Abstract

Quantum technology such as quantum computing, quantum information processing, ultra-sensitive sensors and others, are nowadays one of the most important targets of research. Artificial Intelligence (AI) and Internet of Things (IoT) technology may be further boost by quantum technology. Quantum materials such as topological materials, graphene and similar atomic-layer materials are key components for such technology because of their advantages in ultra-low-energy consumption and quantum phenomena such as entanglement and duality. Looking back at history of science and technology, humankind has devised artificial structures of materials such as hetero junctions and superlattice structures to obtain useful functions, which will be continued with new quantum materials.

I will mainly discuss here three kinds of two-dimensional (2D) atomic-layer materials, graphene, single-atomic-layer alloys, and van der Waals (vdW) crystals of topological insulators, which are grown by molecular beam epitaxy and characterized by some state-of-art techniques in experiments. Their unique atomic structures and electronic states are origins of their interesting physical properties such as 2D superconductivity in graphene (1,2) and atomic-layer alloys (3,4), 2D ferromagnetism, and spin-related transport in topological insulators (5,6).

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