Building artificial crystals by twisting one atomic layer at a time

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Stacking of atomically thin layers provides the interlayer rotational degree of freedom, with which programmed atomic-scale architectures with twisted interfaces can be formed. Many interesting properties have emerged from the structures, ranging from superconductivity to chiro-optical properties [1]. Yet, the demonstrations remain at the small lateral size with limited number of layers, hindering direct applications and further structural engineering. Here, we report large-scale, layer-by-layer assembly of graphene films to produce atomically pristine interfaces with precisely controlled interlayer rotational angles [2]. As-grown graphene films on Ge(110) with weak surface adhesions [3] are physically picked up one-by-one in a clean, dry environment. As results, inch-scale films composed of more than 10 layers of graphene are fabricated with controlled interfaces, offering a novel structural ordering such as helicity with screw-like atomic arrangements. The approach will be useful for building various artificial crystals, and lead to the discoveries of novel electrical and optical properties.

References

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