

Abstract Submitted  
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**Second-layer graphene growth from below on metals**<sup>1</sup> SHU NIE, ELENA STARODUB, NORMAN BARTELT, KEVIN MCCARTY, Sandia National Laboratories — Once a metal substrate is covered by the first graphene layer, CVD processes slow greatly. However, C dissolved in the metal can still segregate to the surface under the first graphene layer. To determine whether these C atoms nucleate a new layer below or above the first layer, we examine growth on Ir(111), where one-layer graphene has several discrete in-plane orientations relative to substrate directions. LEED reveals that the 1st and 2nd graphene layers are not always rotationally aligned in-plane. This misalignment allows determining which sheets are on the top and the bottom by varying the electron energy and thus the escape depth. We first use LEEM to determine the spatial distribution of rotational domains in a single-layer film. We then cool and observe 2nd layer growth. We find that the top sheet of the bilayer has the exact same domain structure as the initially grown single layer. Thus, new layers are added from below. In this mechanism the nucleation and growth of the 2nd layer strongly depends on the difficulty in debonding the 1st layer from the substrate.

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