Epitaxial growth of graphene on SiC on silicon using a Ni/Cu alloy and its applications

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Advances in the epitaxial graphene on silicon carbide wafers have led to exciting developments which may greatly benefit future SiC technologies [1].

On the other hand, the harnessing of graphene's properties on silicon carbide on silicon wafers has generally lagged due to inherent challenges, including the high defectivity of the 3C-SiC template and they substantive stresses involved in the system. However, this approach could deliver an even broader range of reconfigurable functionalities to complement silicon in a system with extreme miniaturisation.

Over the last decade, we have pioneered an epitaxial graphene on 3C-SiC on silicon technology able to overcome many of the historical challenges of this material system. We use a catalytic alloy of nickel and copper to obtain graphene through a process can be described as a hybrid of both conventional epitaxial graphene by SiC decomposition and the growth of graphene from metal foils, drawing crucial advantage liquid-phase epitaxial growth conditions, as we show with operando neutron reflectometry [2].

This platform allows to fabricate any complex graphene nanopattern selectively without etching the graphene, and with sufficient adhesion for subsequent integration [3]. The sheet resistance of epitaxial graphene on 3C-SiC on silicon is comparable to that of epitaxial graphene on SiC wafers, despite substantially smaller grains [4]. Our work shows that the control of the graphene interfaces can be a more important factor than achieving large grain sizes, and that well- engineered defects in graphene are preferable to defect -free graphene for most electrochemical applications [5, 6].

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