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ABSTRACT:

Chemical Functionalization of Graphene to Synthesize a Better Coating

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A continuous layer of graphene would be an effective coating for an underlying substrate because it is chemically inert, impermeable, and has high thermal and mechanical stability. If the aim is to prevent chemical corrosion of the underlying substrate then the efficiency of a graphene a coating can be improved by preventing the intercalation of the reactive species beneath the graphene layer or by preventing the conduction of electrons and ions that encourage corrosive electrochemical reactions. Alternatively, control over the chemical interface between the graphene coating and any overlayer could prevent the build up of damaging materials such as ice.
We use graphene layers on Ir(111) substrates to study graphene as a coating material, and engineer the interaction between the graphene sheet and the metal substrate by chemisorbing H- and O- atoms. The lattice mismatch between graphene and Ir(111) leads to a moiré pattern, with carbon atoms in the graphene lattice and Ir atoms at the metal moving in and out of phase. This gives chemical differences between the carbon atoms at various points in the moiré unit cell. We use this effect to chemically pattern graphene sheets, providing a chemical handle on graphene reactivity. With this we: change the band gap in the graphene layer; selectively form covalent bonds between the metal and the graphene sheet; and introduce new functional groups at the basal plane that can chemically interact with overgrowing ice layers – all with the aim of improving the efficiency of graphene as a coating-material.

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