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Graphene: Atomically thin protective coating DHIRAJ PRASAI, KIRILL BOLOTIN, Department of Physics and Astronomy, Vanderbilt University, JUAN TUBERQUIA, ROBERT HARL, KANE JENNINGS, Chemical and Biomolecular Engineering, Vanderbilt University — We explore the properties of graphene as a cathodic coating to protect copper substrates from oxidation and further corrosion. High-quality and large area graphene films are grown on copper substrates by chemical vapor deposition. Samples were thermally oxidized in an oxygen-rich environment. X-ray photoelectron spectroscopy (XPS) characterization of a Graphene/copper and bare copper samples reveals the absence of oxidized copper at the graphene/copper interface indicating that the graphene monolayer protects the underlying copper. We also determine the protective properties of graphene in aqueous media using electrochemical characterization techniques. First, we use Electrochemical Impedance Spectroscopy (EIS) to show that graphene coated substrates lower frequencies (1Hz) exhibit impedance values 2 orders of magnitude higher compared to bare Cu substrates. Cyclic voltammetry also shows that a monolayer of graphene significantly reduces the oxygen reduction, thus exhibiting little charge transfer at the solid-liquid interface. Finally, we use Tafel analysis to estimate that the corrosion rate exhibited by Graphene/Cu is ~ 7 times lower than that of bare Cu substrates.

Dhiraj Prasai
Department of Physics and Astronomy, Vanderbilt University

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