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Graphene Coatings: A Disruptive Approach to Mitigate Corrosion of Metals and Alloys

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The talk will discuss the challenges in developing graphene coating on most common engineering alloys for remarkable corrosion resistant, and present recent results demonstrating circumvention of these challenges.

Corrosion and its mitigation costs dearly (any developed economy loses 3-4% of GDP due to corrosion, which translates to ~$300b to annual loss USA). In spite of traditional approaches of corrosion mitigation (e.g., use of corrosion resistance alloys such as stainless steels and coatings), loss of infrastructure due to corrosion continues to be a vexing problem. So, it is technologically as well as commercially attractive to explore disruptive approaches for durable corrosion resistance. Graphene has triggered unprecedented research excitement for its exceptional characteristics. The most relevant properties of graphene as corrosion resistance barrier are its remarkable chemical inertness, impermeability and toughness, i.e., the requirements of an ideal surface barrier coating for corrosion resistance. However, the extent of corrosion resistance has been found to vary considerably in different studies. The author's group has demonstrated an ultra-thin graphene coating to improve corrosion resistance of copper by two orders of magnitude in an aggressive chloride solution (i.e., similar to sea-water). In contrast, other reports suggest the graphene coating to actually enhance corrosion rate of copper, particularly during extended exposures. Authors group has investigated the reasons for such contrast in corrosion resistance due to graphene coating as reported by different researchers. On the basis of the findings, author's group has succeeded in demonstration of durable corrosion resistance as result of development of suitable graphene coating.

Keywords: Graphene; Chemical vapour deposition; Corrosion resistance; Coatings.