Graphene Coating for Corrosion Resistance of Metals

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Abstract: We demonstrate great potential of graphene coating as an exciting and durable protective coating against corrosion. The potential of an ultra-thin graphene layer as a corrosion resistant coating for copper, nickel and their alloys is a topic of very recent and exciting research interest (2011-2014). Large area graphene coating is generally synthesized by chemical vapour deposition (CVD). We have employed a low vacuum CVD process for synthesis of multilayer graphene on copper and Cu-Ni (75/25) alloy using n-hexane as hydrocarbon source. The characterization of graphene was done using Raman spectroscopy. The performance of graphene coating on corrosion resistance of Cu and Cu-Ni (75/25) alloy in 0.1M sodium chloride was investigated by potentiodynamic polarization and electrochemical impedance spectroscopy (EIS). The corrosion protection shown by multilayer graphene coating on Cu and Cu-Ni (75/25) alloy was found to be nearly 5 times and 10 times respectively as compared to bare metal. The graphene coated Copper also continues to show corrosion resistance for longer durations of immersion in 0.1 M NaCl (upto 386 h). The level of corrosion protection due to this ultra-thin graphene coating can be further improved by circumventing the challenges in producing defect-free graphene layers.

References

[1] R.K. Singh Raman and A. Tiwari, Graphene: The Thinnest Known Coating for Corrosion Protection, J The Minerals, Metals & Materials Society (JOM),2014;**66**(4):637-42.DOI: 10.1007/s11837-014-0921-3

Figures

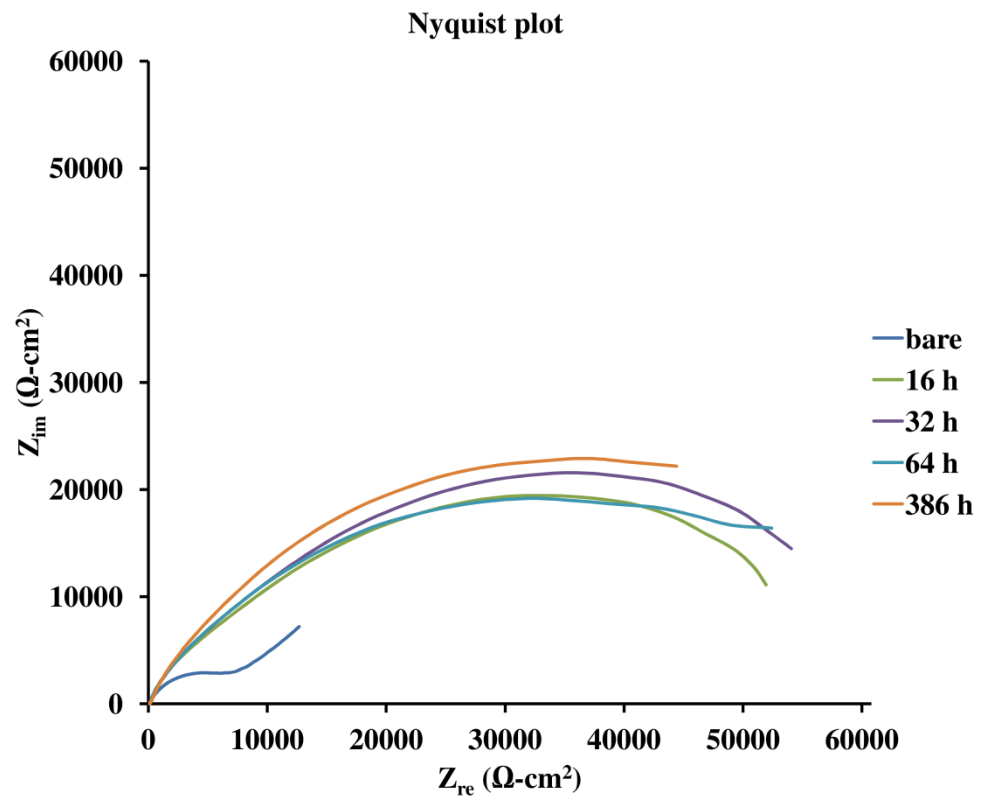

Fig.1: Evolution of Nyquist plots for the graphene coated copper in 0.1 M NaCl for different durations[1] (The corrosion resistance is determined by diameter of semicircular loop in Nyquist Loop.)