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Developing super hydrophobic copper/graphene nano-platelets coatings by plasma spraying

Tahmineh Forati[1], F Ben Ettouil[1], T Kaydanova[2], N Moghimian[2], C Moreau[1], M Pugh1 and **A Dolatabadi[1]**
[1]Concordia University, Canada
[2]Nanoxplore Inc., Canada

Water vapor condensation is frequently used as an effective method of transferring heat using drop-wise condensation on non-wetting surfaces demonstrating enhanced heat transfer when compared to film-wise condensation. The aim of this study is to develop hierarchical surface morphologies on superhydrophobic coatings with high water repellency and mobility using atmospheric plasma spraying (APS). The novelty of this work lies in the processing of the plasma sprayed copper/graphene nano-platelets (GNPs) composite coatings. Retention of the GNPs was made successful by controlling the plasma power and particle injection angle to minimize the temperature and consequently prevent the combustion of GNPs. Several coatings were developed with different surface morphologies. By isolating the effect of surface chemistry using a stearic acid treatment the significance and effect of the achieved morphologies on the wetting behavior of the coatings were investigated. Experimental results demonstrated that coatings produced by the APS process showed excellent water repellency and water mobility: water contact angles as high as 162° as well as water sliding angles less than 1° were achieved due to the hierarchical roughness attributed to the submicron size particles in the feedstock. Moreover, results indicated that Cu/GNPs is a promising surface coating to promote dropwise condensation of water in industrial conditions due to its robust chemical stability with the potential for scalable applications while maintaining low thermal resistance.

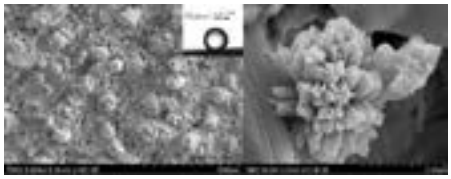

Figure: The SEM micrographs of the Cu-GNPs coating. Inset: a sessile drop of water on this surface

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3. Tong Y, Bohmb S and Song M (2013) Graphene-based materials and their composites as coatings. Austin J Nanomed Nanotechnol. 1(1):1-16.
4. Singh Raman R K, Chakraborty Banerjee P, Lobo DE, Gullapalli H, Sumandasa M, Kumar A, et al. (2012) Protecting copper from electrochemical degradation by graphene coating. Carbon N Y. 50(11):4040-40453.
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Biography

Tahmineh Forati has completed her PhD in Biomaterials Engineering at Islamic Azad University, Sciences and Research Branch, Tehran, Iran in 2014. She has completed her MSc in Biomaterials in 2009, followed by BSc in Material Science and Engineering at the same university. Currently, she is working as a Research Assistant at Concordia University, Canada. Her international experience includes various programs, contributions and participation in different countries for diverse fields of study. Her research interests reflect in her wide range of publications in various national and international journals.

Tahmineh.forati@gmail.com