Industrial graphene coating of low-voltage copper wires for power distribution

Neeraj Mishra[1,2,],Ylea Vlamidis[1,2], Leonardo Martini[1,2], Arianna Lanza[1], Alex Jouvray[3], Marco La Sala[4], Mauro Gemmi[1], Vaidotas Mišeikis[1,2], Stiven Forti[1], Kenneth B.K. Teo[3], Camilla Coletti[1,2]

[1]Center for Nanotechnology Innovation@NEST, Istituto Italiano di Tecnologia, Piazza San Silvestro, 12−56126 Pisa, Italy,[2]Graphene Labs, Istituto Italiano di Tecnologia, Via Morego 30, 16163 Genova, Italy,[3]AIXTRON LTD, Anderson Road, Swavesey, Cambridge CB24 4FQ, United Kingdom,[4]Baldassari Cavi, Viale Europa 118/120, 55013 Capannori (Lucca), Italy.

contact@neeraj.mishra.iit.it

Abstract

Copper (Cu) is the electrical conductor of choice in many categories of electrical wiring, with household and building installations being the major market of this metal [1-2]. In this work, we demonstrate that Cu wires with diameters relevant for low voltage (LV) applications, can be coated with graphene via chemical vapor deposition (CVD). The CVD process is rapid, safe, scalable and industrially-compatible. Graphene-coated Cu wires display oxidation resistance and increased electrical conductivity (up to 1% immediately after coating and up to 3% after 24 months), allowing for wire diameter reduction and thus significant savings in wire production costs. Combined spectroscopic and diffraction analysis indicate that the conductivity increase is due to a change in Cu crystallinity, induced by the coating process conditions, while electrical testing of aged wires elucidates that graphene plays a major role in maintaining improved electrical performances over time. Finally, we demonstrate graphene coating of Cu wires using an open-end roll-to-roll (R2R) CVD reactor, which will enable the in-line production of graphene-coated metallic wires in industrial settings.

References

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Figures

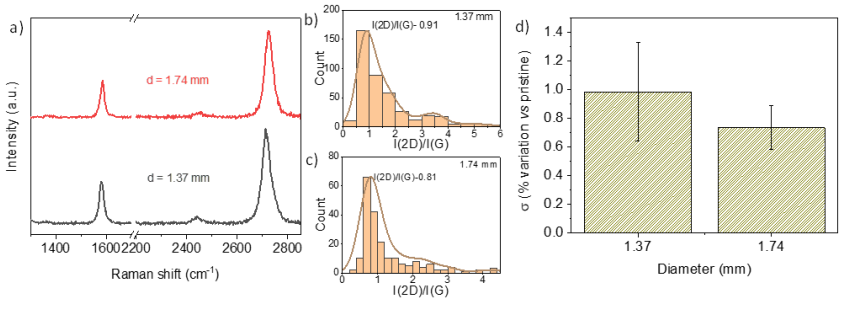

Figure 1: Spectroscopic and electrical properties of Gr-coated Cu wires. Representative Raman spectra (a) and mapping intensity ratio of 2D/G bands (b and c). Electrical conductivity improvement of Gr-coated wires with respect to pristine ones (d). Error bars represent the SDM.

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