Establishing a Testing Method for a Microscale Graphene-Coated Copper Wire

Yisha Ng, Mechanical Engineering
Mentor: Dr. Wonmo Kang, Assistant Professor
School for Engineering of Matter, Transport, and Energy

Objective
Determine and implement an improved testing method to characterize the thermo-electrical properties of microscale graphene-coated copper wire.

Motivation
• Layering microscale copper wire with an axially-continuous graphene coating can improve current carrying capacity, electrical and thermal conductivity, and oxidation and corrosion resistance.
• Added as an insulating layer between a central copper wire and a nickel outer layer, graphene can prevent the alloying and diffusion of the two metals, increasing the usable application temperature.
• Characterizing the thermo-electrical properties of these wires requires a consistent and accurate method to record data.

Methodology
Requirements and available equipment were determined and options for a new test method investigated.

Requirements
• Must apply constant voltage and increasing current until test article failure.
• Must document current, voltage, and time data.
• Prefer method that does not require adding a PC to the existing test setup.

Available Instrumentation
• Keithley 2260B-30-72 720W power supply
• Keithley DMM6500 6 1/2 digit multimeter
• Keithley 2450 SourceMeter

Outcome
• Test functions written in Test Script Processor (TSP) are executed from a USB drive on the 2450 SourceMeter.
• Current (limited to maximum 1A), voltage, and time are measured by the 2450 and written to the USB drive.
• Power is supplied by the 2260B-30-72 commanded by the 2450 via TSPNet LAN commands.
• A PC is not required to run test sequences, although TSP functions can be modified on a computer before being uploaded to the USB drive.

Future Work
• Complete TSP function programming and testing with instruments.
• Create and document a method to generate new functions as needed.

References

Acknowledgements
I would like to thank Dr. Wonmo Kang and Dr. Hamzeh Kashani for their support and guidance, and Vince Woerdeman of Keithley/Tektronix for his technical support.

Wire Configurations with G=graphene (Cross Sectional View)