Title: Graphene-based passivation of liquid metal particle surfaces

Author list: Megan Creighton, Zachary Farrell, Benji Maruyama*, Christopher Tabor*

Metals such as the eutectic gallium- indium (EGaIn) alloy that are liquid at room temperature are of particular interest in fields such as flexible electronics, self-healing circuitry, and soft robotics. They exhibit a unique combination of high thermal and electrical conductivity with mechanical softness but, in contrast to mercury, are nontoxic with low vapor pressures. However, these metal alloys are not without challenges. Trace amounts of oxygen will react with gallium and form an insulating skin layer, which can be a nuisance as it will adhere to most surfaces and leave behind undesirable residue. Gallium will also wet out and react with most other metal surfaces, even at room temperature, so is a poor choice for stable interconnects. The advancement of technologies utilizing these liquid metal materials hinges on the development of new strategies for managing these interfaces.

Graphene oxide (GO) and related materials have been shown previously to function as high performance interfacial micro-barriers in emulsified systems.[1] Here, we expand from previously studied organic/aqueous systems to both metal/aqueous and metal/organic particle dispersions, and are able to demonstrate the first encapsulation of EGaIn liquid metal particle cores by two-dimensional materials. Details discussed will include the role of the continuous solvent and graphene surface chemistries necessary to mediate the self-assembly of the graphene coatings.

1. Creighton, M. A.; Zhu, W.; van Krieken, F.; Petteruti, R. A.; Gao, H.; Hurt, R. H., Three-Dimensional Graphene-Based Microbarriers for Controlling Release and Reactivity in Colloidal Liquid Phases. *ACS Nano* **2016,** *10* (2), 2268-76.