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Polymer/Pristine Graphene Based Composites: From Emulsions to Strong, Electrically Conducting Foams STEVEN WOLTORNIST, Univ of Connecticut - Storrs, JAN-MICHAEL CARRILLO, Oak Ridge National Laboratory, THOMAS XU, ANDREY DOBRYNIN, DOUGLAS ADAMSON, Univ of Connecticut - Storrs — The unique electrical, thermal and mechanical properties of graphene make it a perfect candidate for applications in graphene/graphite based polymer composites, yet challenges due to the lack of solubility of pristine graphene/graphite in water, common organic solvents, and polymer solutions and melts have limited its practical utilization. Here we report a scalable and environmentally friendly technique to form water-in-oil type emulsions stabilized by a graphitic skin consisting of overlapping pristine graphene sheets that enables the synthesis of open cell foams containing a continuous graphitic skin network. At the heart of our technique is the strong attraction of graphene to high-energy oil and water interfaces. This allows for the creation of stable water-in-oil emulsions with controlled droplet size and overlapping graphene sheets playing the role of surfactant by covering the droplet surface and stabilizing the interfaces with a thin graphitic skin. These emulsions are used as templates for the synthesis of the open cell foams with densities below 0.35 g/cm3 and exhibiting remarkable mechanical and electrical properties including compressive moduli up to $\sim$ 100 MPa, compressive strengths of over 8.3 MPa, and bulk conductivities approaching 7 S/m.

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