Novel Graphene Nanoplatelet Embedded Pigmentless Emulsions for Low Cost Paintable Capacitive Sensors and Supercapacitors

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Recent efforts on capacitive sensors and supercapacitor designs have worked towards developing materials that can be seamlessly integrated into devices with irregular geometries and form factors. Graphene Nanoplatelets (GnPs) show tremendous potential for novel paintable sensors and energy storage devices. Variable grades of GnPs were used to fabricate specialized graphene composite films. GnP-NCG015 (150nm to 10μm in diameter) and GnP-EG016 were embedded into a durable, waterproof, and pigmentless acrylic emulsion via ice bath assisted sonication at varying loadings (10-30%) for varying times (30-120 minutes) to determine the effect of loading and sonication time on the resulting surface resistivity, specific capacitance and morphology. Cyclic Voltammetry and Surface Resistivity tests characterized the linear increase in performance with higher loadings and sonication times. However, sonication times of 90 minutes and higher created band gaps in the GnP structure resulting in lower performance. The film morphology, characterized by SEM, showed continuous, uniform networks of graphene nanoplatelets in the polymer matrix. Composite films were applied on six arbitrary surfaces and tested with an ASTM D3359 adhesion test tape which demonstrated zero flaking on all substrates. The films exhibit extremely high durability with surface conductivity retention of 95-99.1% when creased or bent. The results of this novel materials research created multi-property graphene nanoplatelet embedded mediums enabling large interactive surfaces and energy storage devices, on any surface or geometry, via a novel paintable architecture costing less than $1 per square foot.

Awards Won:

European Union Contest for Young Scientists Award

University of Arizona: Tuition Scholarship Award