TSAPS plenary speaker

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Carbon nanomaterial enabled ultra conductive Cu composites

Growing demand for electrical energy and increasing need for high power grid systems necessitates development of new conductors for enhanced electrical and thermal conductivity. The power losses associated with the electrical resistance of Cu adversely impact the efficiency and performance of all electric devices. Ballistic electrical transport in carbon nanotubes (CNTs) is expected to improve the conductivity of the Cu matrix with additional CNT-enabled benefits that can enable low-weight, flexibility, and better thermal management. By using scalable, cost-effective, and commercially viable processing methods, we demonstrate a novel technological platform to produce high-performance conductors that incorporates CNTs into the Cu matrix — ultra-conductive metal composites (UCC), which promise significant technological and economic impact in all energy sectors, ranging from electrical vehicles to power grid. Our technology platform is concentrated on Cu tapes and involves processes from production of stable CNT dispersions, techniques to deposit shear induced aligned CNT coatings along the direction of the current flow, post thermal treatment procedures, and homogeneous deposition of metal overlayers onto CNT coated tapes. Here, we demonstrate that the prototype Cu-CNT composites exhibit improved electrical conductivity as well as higher current carrying capacity than the reference pure Cu. In addition, the impact of using UCCs on the power density of electric motors will be discussed.