CABLE Conductor Manufacturing Prize

Team Name:	*GE Research*
Primary Submitter Name:	Dr. Mohamed Rahmane
City and State:	Niskayuna, NY
Member Names (including partners and affiliates):	Dr. Andrey Meshkov (GE Research) Mr. Steve Buresh (GE Research) Dr. Marshall Jones (GE Research)
Submission Title:	**Electron Beam Melting (EBM) Additive Manufacturing (AM) of Copper-Carbon Composites.**

Description of Material

Copper-Carbon composites, where carbon is introduced in various forms, including powder of graphite, carbon black, or nanostructures forms, such as carbon nanotubes or graphene. The copper is >99.9% pure, in the form of powder, 45-100 microns particle size. The Carbon content investigated is in the range of 0.05 to 5 wt% C.

Fabrication Approach

Electron Beam Melting (EBM) Additive Manufacturing: Powder of Cu is mixed with C (0.05 to 5wt% C) then introduced into the EBM machine for *in-situ* processing of the composite, while 3D-printing actual components. To demonstrate the concept, preliminary studies are performed on a single layer, by pre-processing porous Cu samples with EBM, then infiltrating them with C-black, after which the melting process takes place via EBM.

Potential Impact

- Breakthrough reduction in thermal losses in electrical and thermal systems (Inductors, transformers, filters, rotating electric machines and batteries), with a cost-effective and scalable manufacturing solution.
- Lightweight high-performance Electric Drives for transportation (EV and commercial Aviation), e.g., >3X increase in Power density of electric motors.
- Reduced CO2 emission through broader electrification of transportation