

**2018 Viskanta Lecturer**

**Dr. Baratunde Cola**

Associate Professor

George W. Woodruff School of Mechanical Engineering  
School of Materials Science and Engineering  
Georgia Institute of Technology

***Substrate supported carbon nanotube composites for efficient heat rejection from spacecraft and satellite systems: the commercial realization of more than a decade of fundamental thermal materials research***

**Abstract:**

The nature of aerospace and microgravity systems present unique challenges for the thermal management of onboard electronics in these systems. The vacuum of space eliminates many traditional interface materials due to outgassing, condensation and loss of performance at low pressures. Further complicating the problem are composite structural materials that dictate low allowable clamping pressures and unpredictable variation in interface pressure between bolts in gasketed joints. Vehicles in orbit can experience dramatic temperature swings during the day, necessitating thermal materials with low compression set to accommodate the thermal expansion and contraction of joints. On the exterior, heat rejection via radiation and optical sensors demand surfaces with a combination of high emissivity and thermal conductivity. In some instances space systems have short missions, like conducting microgravity or hypersonic demonstrations where the weight of a steady state cooling solution is difficult to justify.

We will discuss how vertically aligned carbon nanotube (VACNT) arrays grown on foil substrates are well positioned to serve as a platform solution for the unique demands of space systems. VACNTs have excellent deformation mechanics that make them especially attractive for these variable force, cyclically loaded and unloaded systems. The addition of space qualified polymer coatings and adhesives to the thermal tape produce high emissivity surfaces that can be strategically placed on the vehicle without any complicated or time consuming assembly steps. Finally, the VACNT arrays can be impregnated with solid to liquid phase change materials that can store the heat generated during the mission at a safe temperature onboard the vehicle.

**Bio:**

Dr. Cola is Founder and CEO of Carbice Corporation. Carbice is a rapidly growing Georgia Tech spin off in Midtown Atlanta that is developing innovative thermal materials solutions that enable breakthrough optimal performance in electronic devices. Carbice products enable smaller, more powerful electronic devices that are easier to assemble and will unlock mass adoption of affordable connectivity in homes, industry, and from Earth to Mars.

Dr. Cola is director of the NanoEngineered Systems and Transport (NEST) Lab ([nest.gatech.edu](http://nest.gatech.edu)) and co-founder and co-director of the Heat Lab ([heat.gatech.edu](http://heat.gatech.edu)) at Georgia Tech, where he is an associate professor in the George W. Woodruff School of Mechanical Engineering and the School of Materials Science and Engineering. He was Martin Luther King Jr. visiting professor in the Department of Mechanical Engineering at the Massachusetts Institute of Technology in 2016. Dr. Cola co-founded the Academic and Research Leadership Network ([www.arlnetwork.org](http://www.arlnetwork.org)) and serves on the Advisory Board of Vanderbilt University Department of Mechanical Engineering.

Dr. Cola received his degrees from Vanderbilt University and Purdue University, all in mechanical engineering, and was a starting fullback on the Vanderbilt football team. Dr. Cola has published over 70 papers and 10 issued or pending patents related to energy transfer and nanotechnology. Dr. Cola has received a number of prestigious business and technical awards including the Atlanta Business Chronicle 2015 40 under 40; 2012 Presidential Early Career Award for Scientist and Engineers from President Obama for his work in nanotechnology, energy, and outreach to high school art and science teachers and students; the American Association for the Advancement of Science Early Career Award for Public Engagement with Science in 2013; the 2015 Bergles-Rohsenow Young Investigator Award in Heat Transfer from the American Society of Mechanical Engineers; and the 2017 NSF Alan T. Waterman Award.

Dr. Cola lives in Midtown Atlanta with his wife and two daughters.

