

AbstractID: 8731 Title: Carbon Nanotube Field Emission Technology enables Novel Imaging and Irradiation System Development for Cancer Research and Clinical Application

**Purpose:**

Carbon nanotube field emission is an emerging nanotechnology for novel x-ray imaging and radiation delivery systems development for cancer research and clinical application. In this presentation we will give a general review of the nanotechnology and its applications in the development of novel devices including CT imaging, tomosynthesis, and cancer research radiation delivery systems.

**Method and Materials:**

Carbon nanotube field emission is based on the unique properties of a nanomaterial called carbon nanotubes (CNT). CNT is the newest carbon allotrope discovered in 1991 and it is comprised of either a single graphene shell, called the single-wall carbon nanotube, or multiple concentric graphene shells termed a multi-wall carbon nanotube. The signature feature is a very large aspect ratio (ratio of diameter to length) that is typically on the order  $10^3$ . The high aspect ratio makes CNTs a practical and excellent field emitter that can produce high current density with intrinsically small divergence and extremely high temporal resolution. More importantly, its unprecedented flexibility in cathode design has launched new creativity in imaging and therapy system development.

**Results:**

We will show examples of our research development on CNT field emission based imaging and irradiation systems that include 4D micro-RT, stationary tomosynthesis, multi-pixel electron microbeam cellular irradiator under real time microscope observation, and multi-pixel x-ray micro-CT-RT image-guided and intensity-modulated radiation for small animal tumor models. The technical challenges of the CNT field emission technology will also be discussed.

**Conclusion:**

Carbon nanotube field emission technology has shown great promise in developing novel imaging and radiation systems that can potentially advance cancer research and improve the quality and efficiency of cancer diagnosis and treatment.