conferenceseries.com

Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C4-024

Graphene based cathode cold-field emission sources

Anjam Khursheed and Xiuyuan Shao

Over the past decades, the extensive research work carried out on carbon-based cathodes for cold field emission, such as Carbon Nanotubes (CNTs), has not as yet, led to new viable electron sources for electron microscopy/lithography. Their most successful layout has typically been in the form of dots, arrays for large area field emission applications. Nano size emitter single point cathodes have proven to have even more severe problems than conventional single-crystal tungsten cathodes: Unmanageably stringent UHV requirements, relatively large current stabilities and rapid emission decay. These difficulties have prevented the widespread use of cold field emission electron sources for electron microscopy/lithography applications. Recently, the research group at the National University of Singapore, led by Anjam Khursheed, has succeeded in using graphene field emission cathodes for electron microscopy/lithography applications. They have obtained stable field emission from a freestanding graphene ring structure, 5 μm in diameter and a wall thickness of around 3 nm. Another development is the discovery that graphene coated on a Ni sharpened tip dramatically lowers the work function of graphene (by over a factor of 4), enabling it to both provide stable field emission at cathode-tip electric field strengths as low as 0.5 V/nm, an order of magnitude lower than conventional single crystal tungsten point cathodes. This makes it possible to operate the cathode in HV conditions (4×10-8 Torr) and use relatively large cathode-tip sizes (micron sizes). These developments are expected to greatly extend the use of cold field emission electron sources for electron microscopy and lithography applications.

eleka@nus.edu.sg