Room temperature fabrication of 1D carbon-copper composite nanostructures directly on Cu substrate and their field emission properties

ABSTRACT

This paper demonstrates a carbon-copper (C-Cu) composite nanostructure directly fabricated on a copper (Cu) substrate using the Ar^+ ion irradiation method at room temperature. The morphology of C-Cu composite was controlled by a simultaneous carbon supply during ion irradiation. Conical protrusions formed on the surface of the Cu substrate with the low carbon supply rate (R_C), whereas high R_C area prominently produced nanoneedle structures. The field electron emission (FEE) tests demonstrated significant improvement between conical protrusions and nanoneedle structures, where the emission current increase from 5.70 μAcm−2μAcm−2 to 4.37 $mAcm^{-2}$, while the turn-on field reduced from 5.90 to 2.00 Vμm−1Vμm−1.

Keyword: Room temperature fabrication; Carbon-copper composite nanostructures; Cu substrate; Emission properties; Ion irradiation