UNREVEALED ASPECTS OF FIELD EMISSION FROM NANOCARBON MATERIALS

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ABSTRACT

Nanocarbons have been investigated as field emitters from the viewpoints of their intrinsic sharp shapes resulting in geometrical enhancement of electric field as well as their chemical and physical high stability. Recently, interesting field emission features have been reported from nanocarbon materials such as graphitized pencil leads [1,2] and C_{60} adsorbed W tips [3].

Electrons emitted from graphitized pencil leads give energy spectra that are well reproduced by the numerical simulations based on the density of states of graphene, indicating that the most of emitted electrons are originated from graphene at the edge of pencil lead although the pencil leads are prepared by simply breaking the leads perpendicularly and there must be various kinds of graphite-related edges. This result and the effective work function derived from the Fowler-Nordheim (FN) slopes indicate that field emission from graphene should be largely enhanced.

The field emission microscopy (FEM) images from the C_{60} adsorbed W tips include the highly symmetric and larger patterns, that are very similar to well-defined atomic orbitals. These images are considered to be originated from super atomic molecular orbitals (SAMO). This means that FEM visualizes the electronic orbitals energetically resonated to the electron energy.

In this paper, we will discuss the mechanism behind the field emission features from nanocarbon materials above mentioned, comparing with that from graphene/h-BN/Si emitters [4], where graphene hardly gives effects on the energy spectra of emitted electrons from the Si substrate.

References

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