Nano-scale Modification of Diamond Interesting Science and Promising Technology

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Diamond is a unique material with outstanding physical and chemical properties. Among these are very unusual properties of the diamond surface; i.e. its negative electron affinity when hydrogen terminated (i.e. "negative work-function") and the p-type 2D electrical conductivity it shows (when exposed to different atmospheres). These make diamond (and nano-diamond films) a material of choice for the fundamental study of a variety of electron-emission processes as well as for their application, on the nano-scale, as point cold electron-emission devices and various electronic devices.

Results on the emission of electrons from diamond induced by photons (photo emission), by an external electric field (field emission) by electron-impact (secondary electron emission) and by ion-impact (ion-induced electron-emission) will be reviewed. Modifications of these properties on the nano-scale by single ion-impacts and by the application of localized electric fields (from a STM tip) will be described.

Stunning results on huge ion-induced electron emission and their rapid degradation will be presented and explained.

Recent discovery of two-dimensional quantization of carriers in the p-type diamond surface layer will be described.

The possible application of the electron-emission from diamond and nano-diamond layers, for the realization of point sources of cold electrons and for nano scale electronic devices will be discussed.