Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

**Electron field emission from freestanding Diamond nanomembranes and Application to time-of-flight mass spectrometry** HYUNSEOK KIM, University of Wisconsin, Madison, JONGHOO PARK, Kyungpook National University, Daegu, Korea, HYUNCHEOL SHIN, ROBERT H. BLICK, University of Wisconsin, Madison — We introduce a prototype of a freestanding diamond nanomembrane for large protein detection in time-of-flight mass spectrometry. Doped diamond as a material for mass spectroscopy is extremely interesting due to its mechanical and electrical properties. The freestanding diamond nanomembranes we are able to fabricate have lateral extensions of $400\,\mu m \times 400\,\mu m$ with a thickness of 100nm. We employ optical lithography and a Buffered Oxide Etch (BOE) of $SiO_2$ followed by anisotropic etching of the substrate silicon using TMAH solution and finally removing $SiO_2$. The electron field emission from the surface of the membrane is traced in the $IV$ characteristics at room temperature. The membrane is then applied for detection of the large ionized proteins using time-of-flight mass spectrometry. Ion detection is demonstrated in our nanomembrane MALDI-TOF analysis of Insulin (5,735 Da). That is when the ions with a large kinetic energy bombard the nanomembrane, their energy is thermalized upon impact into phonons. The phonons give a thermal energy to the electrons with the membrane, which are then excited to higher energetic states. Given an extraction voltage this leads to electron field emission from the membrane which we labeled phonon-assisted field emission (PAFE). In other words, the MALDI mass spectra are obtained by exploiting ballistic phonon propagation and quasi-diffusive phonon propagation.

Hyunseok Kim
University of Wisconsin, Madison

Date submitted: 09 Nov 2012 Electronic form version 1.4