DNP17-2017-000453

Abstract for an Invited Paper
for the DNP17 Meeting of
the American Physical Society

Plasma-panel based detectors[1]

PETER FRIEDMAN, Integrated Sensors, LLC

The plasma panel sensor (PPS) is a novel micropattern gas detector inspired by plasma display panels (PDPs), the core component of plasma-TVs. A PDP comprises millions of discrete cells per square meter, each of which, when provided with a signal pulse, can initiate and sustain a plasma discharge. Configured as a detector, a pixel or cell is biased to discharge when a free-electron is generated in the gas. The PPS consists of an array of small plasma discharge pixels, and can be configured to have either an "open-cell" or "closed-cell" structure, operating with high gain in the Geiger region. We describe both configurations and their application to particle physics. The open-cell PPS lends itself to ultra-low-mass, ultrathin structures, whereas the closed-cell microhexcavity PPS is capable of higher performance. For the ultrathin-PPS, we are fabricating 3-inch devices based on two types of extremely thin, inorganic, transparent, substrate materials: one being 8-10 m thick, and the other 25-27 m thick. These gas-filled ultrathin devices are designed to operate in a beam-line vacuum environment, yet must be hermetically-sealed and gas-filled in an ambient environment at atmospheric pressure. We have successfully fabricated high resolution, submillimeter pixel electrodes on both types of ultrathin substrates. We will also report on the fabrication, staging and operation of the first microhexcavity detectors (H-PPS). The first H-PPS prototype devices have a 16 by 16 matrix of closed packed hexagon pixels, each having a 2 mm width. Initial tests of these detectors, conducted with Ne based gases at atmospheric pressure, indicate that each pixel responds independent of its neighboring cells, producing volt level pulse amplitudes in response to ionizing radiation. Results will include the hit rate response to a radioactive beta source, cosmic ray muons, the background from spontaneous discharge, pixel isolation and uniformity, and efficiency measurements.

[1]This work was funded in part by a DOE Office of Nuclear Physics SBIR Phase-II Grant