The MicroGeiger: A Beta Particle Radiation Detector

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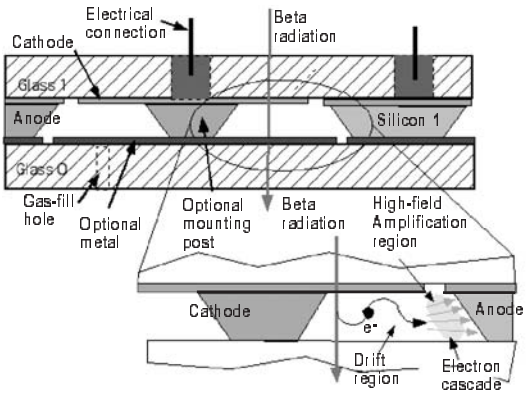

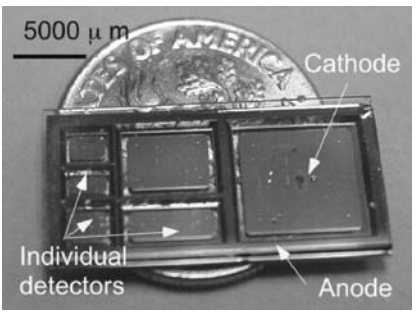

The microGeiger can detect and distinguish the energy of incident beta particles, allowing identification of lethal radioisotopes.

"Dirty bombs," which are conventional explosive devices with radioactive material contained within them, represent a significant threat to national security. For superior detection, characterization, and imaging of these weapons in venues such as airports and public facilities, it is necessary to develop arrayed beta particle detectors that provide spatial imaging to determine the shape or outline of the device. In addition, traditional Geiger counters cannot discern the energy of the incident beta particles. This is essential to diagnose the specific radioisotope—some are lethal, others are not. The microGeiger chip is shown above. An extension of it that places two cavities in the path of a beta particle provides isotope discrimination through particle energy spectroscopy. This technology will enable a field device that describes what and where radioactive material is, and do it in real time. In related research on microplasmas, discharge initiation and current distribution has been studied in the context of microstructures. For microdischarges, most of the glow is confined directly over the cathode. This glow region supports a strong voltage gradient, which is in contrast to traditional plasmas. It is likely that electric fields driven by field emission and secondary emission electrons produce the bulk of the ionization in microdischarges. These results provide important information on placement of electrodes, biasing needs, and ambient pressures preferred for the microGeiger device. The microGeiger project is supported primarily by the Engineering Research Centers Program of the National Science Foundation under Award Number EEC-9986866. The related microplasma research is supported by the National Science Foundation under award ECS 0233174.