Energy Deposition and Transport of Beta Particles, Gamma Rays and Fast Neutrons using Sn-doped Ga_2O3 in Scintillation Mode

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Background: Sn-doped Ga_2O_3 a has been explored for x ray and gamma ray spectroscopy in recent years. The radiation facilities at the Pelletron Lab located at Devcom APG were used for measurements of energy deposition and radiation transport of a variety of radiation sources ranging of energies from 10"s of keV to MeV using Ga_2O_3 spectroscopy'. Accurate determination of energy deposition is important for various radiation oncology therapies and for assessing and predicting environmental exposures and radiation-induced damage in materials used in fission and fusion power reactors.

Methods: Measuring changes in the incident radiation passing through a material of suitable thickness so that the observed differences in spectral shapes and intensities give a direct measurement on energy loss and deposition as a function of depth in selected films which have thickness sufficient to allow good statistical measurements of energy deposition on the scale of 10's of microns. Knowledge of the spectrum of each particular radiation before any attenuating material is placed between the radiation source and the Ga_2O_3 is essential for determining energy deposition and transport. In addition to the transport measurements, we have studied the intrinsic response of Ga_2O_3 to a variety of ion beams and include them in a comprehensive study of scintillation efficiency for electrons, light ions and gamma rays.

Results: We have measured energy deposition for betas emitted in ^{137}Cs, ^{60}Co, ^{234}Th and ^{234m}Pa, along with gamma rays from the first two radioisotopes and from pure ^{235}U. In addition, we have measured attenuation and transport for fast neutrons in the MeV range using the $^{9}Be(p,n)$ reaction. An example of energy deposition and transport for the betas from ^{234}Th and ^{234m}Pa through Kapton and Si is shown in **Figure 1.**

Conclusions: Accurate direct measurements of energy deposition on the 10-micron scale have been made using the spectroscopic capabilities of Sn-doped Ga_2O_3.

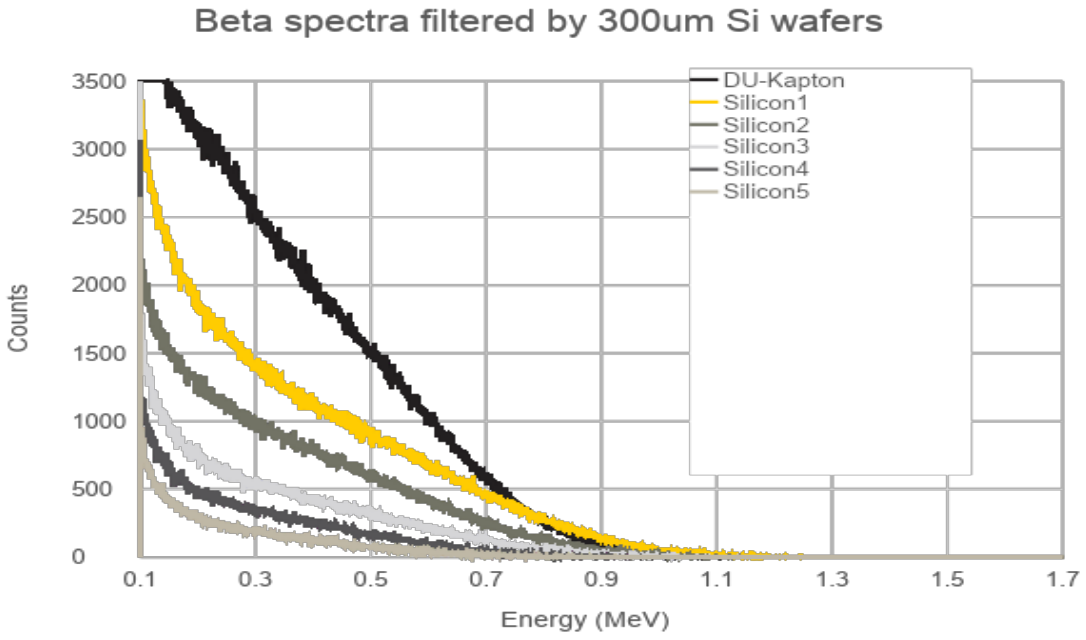

Figure 1. Five 300 um silicon wafers placed in front of Kapton-covered DU disk in succession