NSTD The Nuclear Science and Technology Division

SEMINAR ANNOUNCEMENT

TITLE: Development of an Ion Time-of-Flight Spectrometer for Neutron Depth Profiling

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DATE: **Tuesday, March 18, 2008**

TIME: **10:30 AM**

LOCATION: **Bldg. 5800, Room F202**

Neutron depth profiling is a surface analysis technique that is used to determine the concentration versus depth distributions of certain technologically important light elements. Isotopes such as ^{3}He or ^{10}B undergo (n, p) or (n, α) reactions with thermal or subthermal neutrons. The emitted particles interact predominantly with the electrons of the substrate and rapidly lose kinetic energy. Given the substrate material, the depth of a reaction site can be determined from the residual energy of the particle using the correlations or tabulated values of stopping force. Conventionally, the particle energies are measured with the standard charged particle spectrometry such as a surface barrier detector (SBD) and the associated electronics. The semiconductor detector statistics is a major factor that limits the measurement resolution. It is shown that the ion time-of-flight techniques can be adopted for improved energy resolution. A time-of-flight spectrum is obtained by the time-correlated detection of the ion and a concurrent electron generated in a thin carbon foil. Time-of-flight techniques offer superior resolution especially for heavy and/or slow ions and long ion flight paths. Two design prototypes are introduced and analyzed; experimental measurements are presented. Applicability of the ion time-of-flight techniques to neutron depth profiling is discussed.