Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Spatial Variation in Mobility-Lifetime Product in Bulk TlBr and CZT[1] DAVID PHILLIPS, NANCY HAEGEL, Naval Postgraduate School, KEVIN BLAINE, US Military Academy, HADONG KIM, GUIDO CIAMPI, LEN CIRIGNANO, Radiation Monitoring Devices (RMD) — The energy resolution of a semiconductor radiation detector depends on the charge transport properties of the semiconductor, and the mobility-lifetime ($\mu\tau$) product is a key figure of merit for charge transport. In this work, we investigate the effects of two impurities, Na and Cu, on the $\mu\tau$ product in bulk thallium bromide (TlBr) using cathodoluminescence (CL) and transport imaging. Transport imaging uses a scanning electron microscope to generate a line of charge carriers on the surface of a bulk sample, and the intensity and spatial distribution of the recombination luminescence are recorded. A Green's function approach is used to model the generation, diffusion, and recombination of charge carriers under steady-state conditions. The luminescence distribution is fit to the model to extract the ambipolar diffusion length and the $\mu\tau$ product, providing a high-resolution correlation between the luminescence variations due to dopants/defects and the quantitative transport behavior. The $\mu\tau$ product has been mapped across a 40 μm segment of TlBr at a resolution of 2 μm. Additionally, this approach has been used to locally map variations in ambipolar diffusion length and $\mu\tau$ product due to extended defects in cadmium zinc telluride (CZT).

[1]Supported by DNDO Academic Research Initiative Grant NSF/ARI 083007

David Phillips
Naval Postgraduate School

Date submitted: 06 Dec 2011 Electronic form version 1.4