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1:30pm -2:30pm

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Meeting Information

Meeting link:

https://universityofdc.webex.com/universityofdc/j.php?MTID=m1ef439abb0a306dc968d440ede219341

Meeting number: 132 319 7200

Password: 123456

Host key: 634999

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Recording information:

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Password: CjFsnuk3

Center for Nanotechnology Research and Education Seminar

Low Cost and High Efficiency $^{6}LiInSe_2$ for Thermal Neutron Detectors

Dr. Ashely C. Stowe, Industrial and University Partnerships Program Manager, Technical Fellow, Consolidated Nuclear Security

ABSTRACT:

Semiconductor materials have shown promise as ionizing radiation detection devices; however, to be used as a neutron detector, these materials require the addition of a nucleus with a large neutron absorption cross section (such as ^{10}B or ^{6}Li) to capture thermal neutrons and convert them into directly detectable particles. A semiconducting material that contains the neutron absorber within its regular stoichiometry has the potential to be more efficient than a layered or heterogeneous device at transferring the kinetic energy of the charged particle into the semiconducting material. One class of materials that has shown promise is Li-containing $A^{I}B^{III}X^{VI}_2$ compounds such as $LiGaTe_2$, $LiGaSe_2$, and $LiInSe_2$. These materials have band gaps (2-3.5 eV) appropriate for room-temperature detection of thermal neutrons and would be the first detection material that is simultaneously, exquisitely sensitive to thermal neutrons and acts as a direct conversion device. Recent developments in the growth of $^{6}LiInSe_2$ (LISe) semiconducting crystals have enabled the successful detection of thermal neutrons. The small mean free path of neutrons in this material indicates that a near one-hundred percent detection efficiency is possible with a detector of only a few millimeters thickness. This feature provides an opportunity to create a hand-held detector that has a fast response, minimal dead time, and potentially high gamma/neutron discrimination capability. Investigations into the crystal response, packaging, front end electronics, signal processing, image reconstruction, and modeling are considered. $^{6}LiInSe_2$ has also recently been shown to operate as a scintillator, making it the only neutron detection media which operates both as a semiconductor and scintillator.

BIOGRAPHY

Dr. Stowe is the program manager for the Industrial and University Partnerships office and is the Technology Transfer Lead. He also manages multiple NNSA Minority Serving Institutions Partnership Program (MSIPP) consortia. He previously was named a Y-12 Googin Fellow and Director of the Nuclear Forensics and Detection Initiative. In that role, he acted as a technical lead, coordinating technology transfer and partnerships for radiation detection technologies. Upon completion of his term as Fellow, Ashley became the Fellows Program manager. He joined the Y-12 National Security Complex in 2007 as a Senior Development Chemist. Dr. Stowe was recognized with a 2013 R&D 100 award for his pioneering development of the $^{6}LiInSe_2$ semiconductor radiation detection crystal in collaboration with Professor Arnold Burger of Fisk University.

Dr. Stowe holds multiple adjunct faculty positions at universities across the Southeast in physics, nuclear engineering, and business. He was also instrumental in founding the Southeast Section of the American Association of Crystal Growth. He served as President of the Oak Ridge Chapter of the Sigma Xi Research Society in 2009. He has received four Y-12 Special Recognition Awards; a Technology Use Award; and a Mentor Award for the Mentor-Protégé program, facilitating collaboration with Fisk University. Ashley is also founder and Vice-president of L.I.F.E. Consulting, a leadership development firm which grows leaders and their teams in schools, non-profits, and businesses.

Dr. Stowe earned a Ph.D. in chemistry from the Florida State University. He also holds a MBA from the University of Tennessee; conferred in 2012. He has twenty patents, has authored over 70 peer reviewed publications, and presented over 200 conference presentations. His successes have been recognized by the Knoxville Business Journal as a 2014 *Top 40 Under 40* recipient.