

Photomultiplier Tube Glass Failure in Neutrino Detection: Challenges and Opportunities

Thursday, 23 August 2012 11:25 (15 minutes)

We have undertaken a detailed investigation of photomultiplier tube (PMT) glass fracture at Alfred University, in support of Brookhaven National Laboratory's Long Baseline Neutrino Experiment (LBNE). The strength and lifetime prediction of the PMT glass are crucial to the success of the neutrino detection. Glass fracture is statistical in nature. Glasses are generally under constant state of stress and are susceptible to subcritical crack growth in the presence of water vapor. The crack size increases until the stress intensity at the crack tip exceeds the fracture toughness or critical stress intensity factor and failure occurs. Major challenges include lack of fracture mechanics data on the PMT glasses, predictive model of their failure, and fundamental understanding of the processes and mechanisms of their failure under the neutrino detection environments. With systematic static fatigue testing and accelerated testing in the laboratory, a database can be assembled. Additionally, relationship between glass chemistry and PMT failure can be also developed. With proof-testing data, we can develop and validate a predictive model. We will present our preliminary crack growth results on PMT glasses from vendors.

Primary author: Prof. SUNDARAM, S. K. (Kazuo Inamori School of Engineering, Alfred University)

Co-author: Prof. DIWAN, Milind (Brookhaven National Laboratory)

Presenter: Prof. SUNDARAM, S. K. (Kazuo Inamori School of Engineering, Alfred University)

Session Classification: Photo-sensor Development