Performance of Large Size LYSO Crystal Batches

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Because of their high stopping power and fast and bright scintillation light, cerium doped lutetium oxyorthosilicate (Lu$_2$SiO$_5$:Ce, LSO) and lutetium-yttrium oxyorthosilicate (Lu$_2$Y$_{2-x}$SiO$_5$:Ce, LYSO) crystals have attracted a broad interest in the physics community pursuing precision electromagnetic calorimeter for future high energy physics experiments. Their excellent radiation hardness against gamma-rays, neutrons and charged hadrons also makes them a preferred material for calorimeters to be operated in a severe radiation environment. Figure 1 shows twenty-five LYSO crystals with a slightly tapered shape 20×23×200 mm grown by Saint-Gobain, SIC and SIPAT for the SuperB experiment. Figure 2 shows ten rectangular LYSO crystals with dimension of 30×30×130 mm and two hexagonal LYSO crystals of 18.6×130 mm grown by SIC for the Mu2e experiment.

Optical properties, including excitation, emission and transmittance spectra, and scintillation properties, including light output, decay time and light response uniformity, were measured in the Caltech HEP Crystal Laboratory. Correlations between optical and scintillation properties were investigated. Results of these investigations indicate that the quality of large size LYSO crystals grown in industry is adequate for future HEP calorimeters at both the energy and intensity frontiers.