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Report on the performance of a dual-mode inorganic scintillator TLYC[1] CHING-YEN WU, JACK HENDERSON, Lawrence Livermore Natl Lab — TLYC ($Tl_2^6LiYCl_6$, $\geq$ 95% ^{6}Li, 75.8% ^{35}Cl, ρ = 4.5 g/cm^3) is a dual-mode inorganic scintillator with the capability to detect both neutrons and γ rays with good energy resolution. The γ-ray energy resolution better than 4% was reported for a crystal size of 1" x 1". Unlike most neutron detectors which depend on the time-of-flight technique to determine the energy, TLYC can be sued to measure the neutron energy directly through charged-particle creating reactions on the constituent isotopes. A resolution better than 10% for fast neutrons with energies up to 8 MeV was obtained for the same class of scintillator, CLYC (Cs_2LiYCl_6), where cesium is replaced by thallium for the molecular formula of TLYC. It opens the door for many applications. A crystal size of 1" x 1" is acquired recently and an extensive test is carried out using a ^{252}Cf PPAC to characterize the pulse-shape discrimination between neutrons and γ rays as well as the energy and timing resolution. The prompt fission neutron and γ-ray spectra can be measured by TLYC in coincidence with the detection of fission fragments by PPAC. The detector response for both neutrons and γ rays can be measured simultaneously using this coincident technique. The characterization of those performances will be presented.

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