

Heat Shrink Polyethylene Terephthalate as a Dielectric Material for HTS Power Cables

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Abstract—The idea of individual high temperature superconducting (HTS) tapes insulated with Polyethylene Terephthalate (PET) heat shrink was explored as an option for the dielectric design of power cables. Systematic selection criteria were developed to select the appropriate size of the heat shrink for given HTS conductor dimensions. The dielectric characteristics of insulated HTS tapes were measured at 77 K in liquid nitrogen and gaseous helium environments. Dielectric characteristics of tapes with single layer of thicker insulation were compared with multiple layers of thinner insulation to evaluate the relative merits of each method of applying the required thickness of the insulation. Both methods resulted in a similar breakdown strength. 1 m long model power cables were fabricated using the PET insulated tapes and their dielectric behavior was characterized at 77 K in gaseous helium environment. The dielectric design involving individual insulated HTS cables is useful for some selective applications due to the ease of developing continuous manufacturing process.

Keywords (Index Terms)— Breakdown voltage, cryogenic dielectric characterization, cryogenic helium, HTS power cables, partial discharge, Polyethylene Terephthalate (PET).

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