Contribution ID: **125** Type: **Invited Oral**

C2Or3C-01: [Invited] Design, Configuration and Thermal Optimization of Advanced Cryostats

Tuesday 11 July 2023 16:15 (30 minutes)

Cryostats for research and testing applications have been designed and implemented successfully for many years. The design features are selected to provide for the desired functionality with the most efficient operation, particularly with regard to refrigeration requirements. In this paper we introduce engineering figures, calculated table-plots and representative equations for the design, configuration, and thermal optimization of advanced cryostats for different typical cold masses in current and future applications. For example, the cold mass contained and thermally isolated in the cryostat could be a quantum apparatus, test specimen for property characterization at low temperatures, in-space simulation for instruments, thermo-fluidic research, or a superconducting device, to mention a few. All these must operate at cryogenic temperatures while providing all functional interfaces for power and instrumentation to obtain the required data. Also included are in-depth discussion of the design methodologies for crucial cryostat components including: 1) the light-weight structure of cold mass supports and allocation of thermal anchors to the best temperature spots, 2) designs of MLI systems and associated cost-efficient minimization of radiation heat via intermediate shields, 3) the sophisticated structures required to house heavy current leads or RF couplers while also preventing heat flows from reaching the cold mass in cryostats with active cold masses such as SC magnets or SRF cavities.
To demonstrate the integration of these technologies into cryostat design, we also present several cryostat configurations suitable for various cooling methods including cryogen baths, cryogen-free cryocoolers, continuous cryogen flow, and below 1-K with dilution-demagnetization. Lastly, we describe a few special cryostat designs that are suitable for unique testing requirements such as laser windows and horizontal loading.

Authors: Prof. SHU, Quan-Sheng (Retired Scientist); Prof. DEMKO, Jonathan (LeTourneau University); FESMIRE, James (GenH2); DUCKWORTH, Robert (Oak Ridge National Laboratory)

Presenter: Prof. SHU, Quan-Sheng (Retired Scientist)

Session Classification: C2Or3C: Miscellaneous II