SHI's Two-Stage 4 K GM Cryocoolers: Enriching Emerging Technologies through Leading-Edge Advancements

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The SHI Cryogenics Group, along with its parent company Sumitomo Heavy Industries, Ltd., is a global leader in cryogenic technology. During its 60-year history it has grown to design and manufacture the broadest array of cryocoolers and related cryogenic systems worldwide, serving magnetic resonance imaging (MRI), semiconductor, laboratories, aerospace and other research applications. Aligning with our goal to create a better tomorrow through innovative solutions, we particularly support emerging technologies through advancements in cryocooler development, and provide exceptional performance and service through our global network.

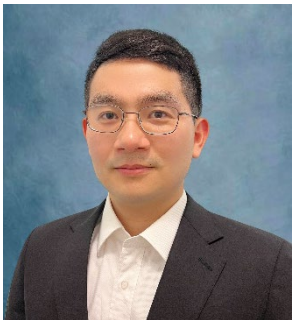
With our customers facing helium supply shortages and higher costs, we developed the leading-edge RDE Two-Stage 4 K Gifford-McMahon (G-M) Cryocooler Series, enabling the move from a full helium bath design to the low cryogen design used by the latest MRIs. Specifically, we will present the RDE-418D4 Cryocooler, which increases cooling performance by 20% over our previous model and provides 2.0 W at 4.2 K and 50 W at 50 K, with a power consumption as low as 7.5 kW at 60 Hz.

For the fast growth of quantum technologies, our RDK-101D(L) cryocooler, which is the world's smallest two-stage 4 K Cryocooler, continues to evolve and enables supporting applications like desktop quantum systems, single photon detectors and optical quantum systems. This innovative, low-vibration cryocooler features a guaranteed minimum temperature of <2.3 K and provides 0.16/0.2 W at 4.2 K (50/60 Hz) with about 1 kW input power. Our pulse tube refrigerator product line also has expanded rapidly, with the newest model, RP-222B3S, providing 2.0 W at 4.2 K and more for scaling-up dilution refrigerators and quantum computing systems.

These cryocooler innovations, as well as their performance characteristics and applications, are presented and discussed.

Speakers

Dr. Mark Derakhshan was named President and Chief Executive Officer of Sumitomo (SHI) Cryogenics of America, Inc. (SCAI) in April 2021, overseeing operations in five facilities across the United States. He joined SCAI in March 2019 as Director, SCAI Engineering, leading and supporting new product development and other related initiatives.
Prior to his time with SHI, Dr. Derakhshan gained over 20 years of progressive engineering and managerial experience in the healthcare diagnostic imaging industry, including 14 years in MRI magnet design and development. He holds a Ph.D. in Mechanical Engineering from Tennessee Technological University and has authored over a dozen patents within the healthcare industry.



Dr. Tian Lei is currently a Principal R&D Engineer with Sumitomo (SHI) Cryogenics of America, Inc. (SCAI). He received his B.S. degree in 2009 and M.S. degree in 2012 from the Zhejiang University, China, and his Ph.D. degree in 2016 from the Technical University of Denmark, all in Mechanical Engineering. His research explores the development and application of regenerative cooling systems, including thermoacoustic engines, magnetocaloric refrigerators and regenerative cryocoolers. He has authored or coauthored over 40 journal and conference articles and over 10 patents. His current research interests include efficient Gifford-McMahon and pulse tube cryocoolers, and their applications.