Large Capacity Cryocoolers and Cold Helium Circulation Systems for HTS Applications

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We have developed large capacity single stage GM cryocoolers with cooling temperatures from 11 K to 80 K. They have been used for HTS applications, such as FCLs, SMES, motor/generator, HTS cable and HTS magnets, etc. A Model AL325 is designed for 25 K operation, which can provide a cooling capacity of 110 W at 25 K. The current development of the AL325 is to replace lead in the regenerator for RoHs compliance. The model AL600 GM cryocooler was improved to have a cooling capacity of 700 W at 80 K, with the highest relative Carnot efficiency of 15.3%. This cold head vibration has been analyzed and reduced significantly.

Two types of cold helium circulation system using AL300 GM cryocoolers (300 W at 80 K) have been developed recently to circulate cold helium for remote cooling. A new compact, low cost cold helium circulation system could provide >180 W at 80 K at a remote location. In this system, a set of check valves connects to the cold head expansion chamber to convert a small portion of AC oscillating flow in the cold head to DC gas flow for circulating cold helium in the remote loop. Another cold circulation system with a cryogenic fan has been developed for other applications. The system with AL300 GM cryocooler and 3 meters long transfer line has 84 W at 40 K, 183 W at 60 K and 260 W at 80 K at remote cooling heat exchanger. Cooling Capacities of these cold helium circulation systems could be doubled with AL600 GM cryocooler.