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C1Po1C-01 [05]: Development of a kW-class Stirling cryocooler for liquefaction of natural gas

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Our research group has developed a kW-class Stirling cryocooler. The Stirling cryocooler adopts a 'gamma-type'configuration operated with a linear compressor. The cold-end of the Stirling cryocooler is equipped with a heat exchanger that can accept and eventually liquefy natural gas (NG). The liquefied natural gas (LNG) is stored in an auxiliary reservoir. In this research paper, the experiments as a proof of concept has been carried out. The Stirling cryocooler has been sorely tested prior to adopting the heat exchanger as the aforementioned above. It has been confirmed that the Stirling cryocooler can exert over 1 kW cooling capacity at 110 K cold-end temperature with 9 kW compressor input. This research paper mainly focuses on (1) relevant technical issues during the cooler development process and (2) demonstrating the liquefaction of argon gas (instead of using NG for the sake of safety regulation). The system presented in this paper, therefore, can be a good candidate for a small-scale liquefier does not require oil-involved maintenance.

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