

Enhancement of Linear Compressor Power and Performance Improvement of Pulse Tube Refrigerator

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The performance improvement of pulse tube refrigerator is investigated by amplifying the power of the cold linear compressor. In a previous research, the cold linear compressor which operated at liquid nitrogen temperature successfully demonstrated producing sufficient PV power for operating a pulse tube refrigerator to reach 20 K. Although the pulse tube refrigerator using a cold compressor achieved the cooling power of 0.4 W at 20 K, it was found that the regenerator performance was poor because of the insufficient output power from the compressor. To increase the output power using the same linear motor, a new piston-cylinder assembly has been fabricated. The diameter of the piston is enlarged from 27 mm to 33 mm and the surfaces of the piston and the cylinder are coated with PTFE and Nickel, respectively. The linear compressor using new piston produces about 80 W of PV power, which is 60% larger than the previous result. The cooling performance of the pulse tube refrigerator is, therefore, improved accordingly with more input power. The pulse tube refrigerator achieves no load temperature of 17.8 K and the cooling capacity of 1.1 W at 20 K. The paper elucidates the detailed design issues of incorporating a cold linear compressor for pulse tube refrigerator.