

Indigenous development of helium liquefier

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Abstract

Helium Liquefiers/ refrigerators have become an essential part of future accelerator developments in India. Apart from designing, systems operating at liquid helium temperature viz. 4.2 K or lower, require additional technical skills to make them work as designed. To get insight in these intricacies, development of helium liquefier was taken up at RRCAT.

An indigenous helium liquefier has been developed. This system is based on reciprocating type expansion engine and uses cross counter flow type heat exchangers, based on high finned density copper tubes. The cyclic compressor is a four stage air cooled reciprocating type compressor. Its oil removal system is also designed and developed indigenously. Initially, a liquefaction rate of 6 lit/hr was achieved. More than 150 liters of liquid helium was collected during its maiden trial itself, while operating for more than 25 hours continuously. This liquefier has at present crossed a liquefaction rate of 10 lits/ hr by further tuning and reducing thermal in-leaks.

Based on the experience gained in the present system and validation of design parameters under actual working conditions, a second model is being designed, which will be able to produce about 35 lit/ hr of liquid helium. Further work is also being initiated to develop aluminium plate fin heat exchangers for developing helium liquefiers of larger capacity in the range of 100 – 200 lits/hr.

Design, development and performance details of indigenous development of helium liquefier will be presented and ongoing efforts to increase the liquefaction capacity will be discussed.