STUDY OF ABSORPTION IN REFRIGERATION SYSTEMS

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Abstract :
The energy and global warming crises have drawn renewed interests to thermally driven cooling systems from the air conditioning and process cooling fraternities. The early development of an absorption cycle dates back to the 1700's. It was known that ice could be produced by an evaporation of pure water from a vessel contained within an evacuated container in the presence of sulfuric acid. In 1810, ice could be made from water in a vessel, which was connected to another vessel containing sulfuric acid. As the acid absorbed water vapor, causing a reduction of temperature, layers of ice were formed on the water surface. The major problems of this system were corrosion and leakage of air into the vacuum vessel. In 1859, Ferdinand Carre introduced a novel machine using water/ammonia as the working fluid. The lithium bromide-water absorption chiller is one of the favorite due to the following specific reasons: (a) it can be thermally driven by gas, solar energy, and geothermal energy as well as waste heat, which help to substantially reduce carbon dioxide emission; (b) its use of water as a refrigerant;(c) it is quiet, durable and cheap to maintain, being nearly void of high speed moving parts; (d) its vacuumed operation renders it amenable to scale up applications. The internal operation of a lithium bromide-water absorption chiller is intimately influenced by the pressures and concentrations of its working fluid. In its most basic form, there are four intrinsic components to a lithium bromide-water absorption chiller: an evaporator, a generator, an absorber and a condenser. In the generator refrigerant vapour is thermally desorbed from the solution, which is then condensed in the condenser. The liquid refrigerant in the condenser is throttled and sent to the evaporator where cooling is provided. In the evaporator, the liquid refrigerant vaporizes and the vapour is absorbed by the solution which is actively cooled in the absorber. The refrigerant rich solution is pumped to the generator for generation, while the resultant refrigerant-weak solution is throttled back to the absorber to absorb the refrigerant vapour coming from the evaporator. To improve the system efficiency, a solution heat exchanger is introduced into the solution circuit to recover the energy of the refrigerant-weak solution when it is throttled from the generator to the absorber. The performance index of an absorption chiller is termed the Coefficient of Performance (COP) and is generally defined as the ratio of cooling output at the evaporator to the heat input to the generator. The aim of this paper is to study the absorption refrigeration. A number of absorption refrigeration systems are examined and discussed. The study shows that double-effect absorption systems using lithium bromide/water seem to be the only high performance system which is available commercially It must be noted that, when the number of effects increase, COP of each effect will not be as high as that for a single-effect system. Moreover, the higher number of effect leads to more system complexity.