Sorption Cooling for Efficient Use of Waste Heat

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Abstract:

This presentation will introduce the research and progress on high efficiency open cycle sorption cooling driven by low grade thermal energy, such as waste heat, etc., and thermodynamic performance of such kind of cooling cycles.

Open cycle sorption cooling is also known as desiccant cooling. It works in principle of desiccant dehumidification and evaporative cooling, and is advantageous in harvesting the low grade thermal energy more efficiently. The cooling cycle can be operated even the temperature of the heat resource is as low as 50℃. Hence, the technology is always used at the last stage to improve the energy efficiency in cogeneration system.

Due to the effect of sorption heat, the system performance can not be improved to a big extent. Great efforts are being made to minimize the influence of the sorption heat by optimizing the thermodynamic processes of desiccant dehumidification in this project, including use of internal cooling, development of multi-stage dehumidification cycle, etc. It is estimated that the thermal COP of the desiccant system can reach as high as 1.2 under ARI conditions.

It is also important to develop the advanced desiccant materials that are more hygroscopic and performs well dynamically. By improving the porosity of the desiccant materials and modifying the adsorption surface, the driven temperature of the dehumidification and cooling cycle can be significantly reduced. Meanwhile, the adsorption rate can be effectively improved.

Dynamic performance of the system is also being extensively investigated for the purposes of both dehumanization and air conditioning, as well as for integration with the existed cogeneration system. Optimization will also be made to increase the energy conversion efficiency.

The objective of this project is to develop the advanced thermodynamic cooling cycles based on open cycle sorption cooling, to identify the reasonable operation and control mode, and to work out the ideal properties of the desiccant materials that is good for using of waste heat.

Keywords:

desiccant dehumidification, waste heat, cooling, sorption, energy efficiency