BRIEF OVERVIEW ABOUT SORPTION MEDIA AND THERMAL FLUIDS

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Abstract:

Nowadays one of the major challenges in industry is the development of energy efficient processes and applications resulting in a sustainable treatment of our environment. In this context, a particular attention should be paid to an efficient use of waste heat & solar thermal heat, which are both large ressources of energy. It is necessary to identify and develop powerful media for heat storage & heat transport. Ionic liquids as innovative class of substances are proven to be suitable candidates.

One approach is the application of IL in sorption techniques to transfer the "poor" waste heat into useful "rich" heat or cooling. Their negligible vapor pressure and their liquid state over wide temperature range qualify them for this adoption. Furthermore, they can be designed to have a high affinity for the evaporating solvent and to be non corrosive. In cooperation with the Institute of Technical Thermodynamic Karlsruhe (ITTK), we have demonstrated the use of IL in sorption cooling devices. A mixture of diethylmethylammonium methanesulfonate (DEMA $MeSO_3$) and water was tested in 10 kW-apparatus. The COP (Coefficient of Performance) was found to be comparable to the one of lithium bromide (LiBr)/water, although the higher viscosities of the used working solutions with RTILs still cause an insufficient heat and mass transfer. Thus, further optimization of the fluids is still necessary.

Their high heat capacity, low vapor pressure and non inflammability make them also promising candidates as thermal fluids. In this context, a limiting factor is the thermal stability. The long term stability of some ionic liquids can reach values of slightly above 250°C, which is interesting, if the negligible vapor pressure is brought also into considerations. However, the major challenge is to design and to develop fluids with enhanced long-term thermal stabilities. Based on our investigations we will report an overview about thermally stable ILs. By pre-selecting a comprehensive matrix of different anions and cations from our substance library of more than 600 compounds, using known physical and chemical data from literature and from our data pool, we identified in carefully chosen screening tests novel interesting structural motifs. The relation between structure and technical performance will be discussed. Finally, an outlook on upcoming commercial applications will be given.