PERFORMANCE OF TWO ABSORPTION-COMPRESSION HYBRID REFRIGERATION SYSTEMS USING R1234ZE(E)/IONIC LIQUID AS WORKING PAIR

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ABSTRACT

Energy consumption is growing fast all over the world, the low-grade heat like solar energy, geothermal energy and waste heat released during industry processes is viewed as a source of recyclable energy. Absorption refrigeration technology has attracted much attention and been investigated from different aspects in recent years due to its feasibility to be driven by low-grade heat. However, the most commonly used working pairs of the absorption refrigeration system are NH_3/H_2O and H_2O/LiBr have some obvious drawbacks including crystallization, corrosion, negative pressure operation and toxicity, *etc*.

Ionic liquids (ILs) are a class of liquid salts with many advantages such as non-volatility, good thermal and chemical stability, low melting point, nontoxicity, etc. Hydrofluoroolefin (HFO) is the promising alternative of HFC, which has no damage to ozone layer and nearly won't lead to global warming. Therefore, HFO/IL is a kind of promising working pair to replace H_2O/LiBr and NH_3/H_2O.

In this work, two new absorption-compression hybrid refrigeration systems using R1234ze(E)/[HMIM][BF_4], R1234ze(E)/[EMIM][BF_4] and R1234ze(E)/[OMIM][BF_4] as novel working pair are proposed. The effects of compressor position, compression ratio, generation temperature, evaporation temperature, condensation temperature and absorption temperature on the coefficient of performance (*COP*) and circulation ratio (*f*) were analyzed. Comparison result shows that the two systems have many advantages over the single-effect absorption refrigeration system including increasing *COP*, reducing the heat load of condenser and *f*, and enlarge the operation range of generation temperature, evaporation temperature and absorption temperature. R1234ze(E)/ [OMIM][BF_4] shows better cooling performance than R1234ze(E)/[EMIM][BF_4] and R1234ze(E)/[HMIM][BF_4] due to its favourable thermophysical properties.