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Rotary Magnetic Refrigeration Prototype: Initiative Research and Prototype Development in Thailand

A rotary magnetic refrigeration (MR) prototype is designed and developed in this work. The numerical simulation of the MR with Gd magnetocaloric materials (MCM) and layered La-alloy MCM were performed to compare the MR performance. The MR prototype consists of (i) the rotary permanent magnet (PM) system, (ii) the active magnetic regenerators (AMR, and (iii) the heat exchange fluid flow controls. The rotary magnet system was designed using COMSOL AC/DC module. The rotary PM system was built and tested with the resultant maximum magnetic field of 0.65 tesla and minimum field of 0 tesla. Two types of the AMR bed contains packed Gd MCM and La-alloy MCM. The temperature of MCM solid refrigerant increases with adiabatic magnetization and decreases with adiabatic demagnetization. Heat exchange fluids must be used to exchange and transport heat from the MCM refrigerants to cold and hot heat exchange units. The preliminary test showed that the MR prototype exhibits the maximum temperature span of 1 –2 oC at no thermal load. The MR prototype demonstrated the magnetocaloric effect. The ongoing development and improvement of the MR prototype is to improve the temperature span and cooling power with more effective fluid flow and heat exchange of the MCM refrigerants.

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