
SESSION 8: Magnetic Refrigeration

Paper 8.4 Wednesday POSTER Session 1:15 to 2:45 PM

Development of Active Magnetic Regenerative Refrigerator (AMR) with Rotating Permanent Magnet

K. Natsume, T. Numazawa, A. Uchida, T. Seki, and K. Kamiya, NIMS, Tsukuba, Japan; and K. Matsumoto, Kanazawa Univ., Kanazawa, Japan

An Active Magnetic Regenerative Refrigerator (AMR) utilizes the magnetic entropy change of magnetic materials by applying the external magnetic field to induce exothermic and endothermic reaction: magnetocaloric effect. The magnetic material containers for our AMR are arranged horizontally in a radial pattern, eight at 45 degrees each. Rotating permanent magnets for applying the magnetic field are similarly arranged four at 90 degrees each, and can repeatedly magnetize and demagnetize the magnetic materials at each 45 degree rotation. Granular magnetic materials for AMR are used not only for their magnetocaloric effect, but also for their regenerative effect by enclosing them in containers that allows heat exchange gases to flow through the spaces between the grains. A temperature gradient can be created in the magnetic material container by flowing the heat exchange gas in opposite directions after the magnetic material is magnetized and demagnetized, respectively. The developed AMR was designed for research purposes aimed at the recondensation of liquid hydrogen, and the operating temperature was set close to 20 K. A 20 K-class single-stage GM refrigerator was used for the waste heat from the AMR cycle, with the waste heat temperature of about 30 K. The magnetic field applied to magnetic materials is up to 1 T. Refrigeration operation has been performed using approximately 230-630 g of HoAl₂ or HoB₂ as magnetic materials and the results will be reported in the presentation.