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"Thermo-fluid dynamics characterization and optimization of the Rotary Permanent Magnet Magnetic Refrigerator operating at room temperature"

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ABSTRACT

The main purpose of the present work was the completion and the thermo-fluid dynamic characterization of a Rotary Permanent Magnet Magnetic Refrigerator operating at room temperature.

The experimental device consists of 8 static regenerators packed with gadolinium (Gd) spheres inside a rotating two-pole permanent magnet with a magnetic field of 1.25 T and an air gap of 43 mm. A rotary valve mechanically coupled to the field generator imparts the direction of heat transfer fluid through the regenerators.

A parametric study of the temperature span, cooling power and coefficient of performance (COP) was carried out over a range of different hot reservoir temperatures, volumetric flow rates, cycle frequency and cooling powers.

The experimental investigation has been identified by 468 tests on 33 measured quantities, obtaining the thermo-fluid dynamic characterization of the complete machine in stationary operation.

Finally, with the aim of optimising the performance of the prototype, a new regenerator has been developed. The new design allows reducing the dead volume and improves the fluid distribution around the magnetic refrigerant.