Comparison of calculation and experiment of electromagnetic force for a large axial electromagnetic bearing

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In the High Temperature Reactor- Pebble-bed Modules (HTR-PM) which is being constructed in Shandong province, China, the Active Magnetic Bearing (AMB) is used in the main helium blower. A prototype of the main helium blower was made for research, and its AMB was designed by Tsinghua University.

The AMB of the prototype is large. The diameter of the axial bearing is about 600 mm. The axial load is also large, and the bearing will be used in limiting condition. So the calculation of the electromagnetic force should be very accurate.

The force was calculated by the commercial software, Ansoft Maxwell. At the same time, an equipment was established to measure the actual electromagnetic force. The calculation model and the schematic of the equipment are shown in Fig. 1. Through measuring the magnetization curve of the materials in large range of magnetic field intensity, the deviation of the calculation value could be smaller than 10%. An example is shown in Fig. 2.

The electromagnetic force for different materials was calculated and measured. It's found that the influence of the stator material is quite larger than the one of the thrust material.

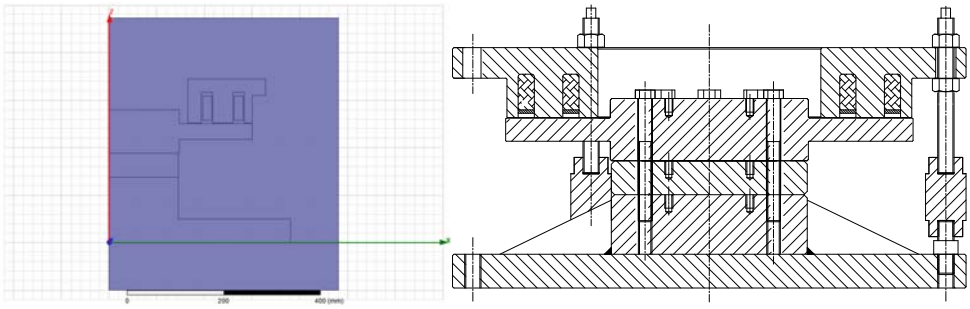

Figure 1. Left to right: calculation model and experiment equipment.

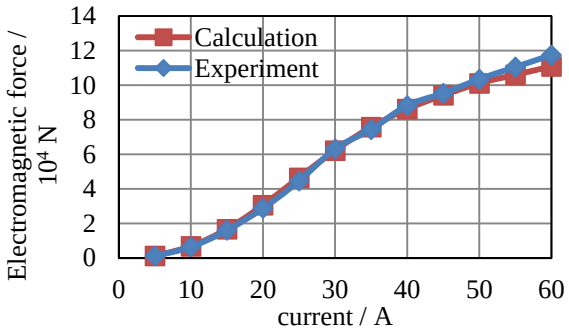

Figure 2. Comparison of calculation and experiment.