Chair of Metal Forming and Casting
TUM School of Engineering and Design
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Casting technology approaches to increase the efficiency of asynchronous motors

Motivation

While the influences of the manufacturing process of electric sheet metal on its magnetic properties and on the loss fraction of the overall motor have been adequately investigated, the casting of the sheet metal into squirrel-cage rotors has so far represented a gap in the known cause-and-effect chain of asynchronous motors. A profound understanding of the influences of casting technology on the resulting electromagnetic characteristics of the rotor of an asynchronous motor makes it possible to increase the efficiency of electric motors. This in turn makes a significant contribution to environmental protection by conserving fossil resources and reducing climate-damaging CO2 emissions.

Approach

The aim of the project is to increase the efficiency of asynchronous motors by systematically analyzing the factors influencing casting quality and the magnetic properties of the electrical sheets after casting. The casting processes used are low-pressure casting and gravity casting. (see Figure 1).

For the main tests a simplified rotor geometry is used, whose geometric dimensions allow the use of the ring core measurement method for the magnetic characterization of the rotors (see Figure 2). In addition to the casting tests, the influence of the temperature on the sheet stack is examined with the aid of heat treatment tests as well as the influence of the mechanical load is investigated separately. Besides the main tests, additional casting experiments are carried out on a real geometry, which, when used in an engine test rig, allow the influence on efficiency to be quantified.

Figure 1: Research low-pressure casting machine for casting squirrel-cage rotors, minimum casting time < 1 s at more than 50 mbar/s

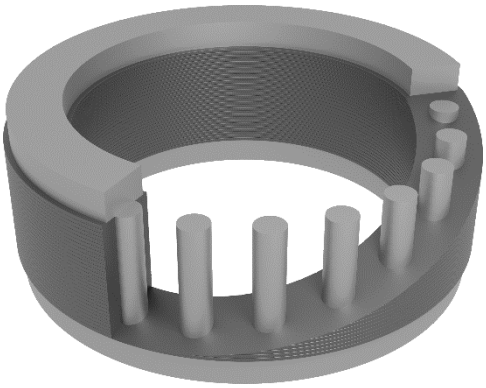

Figure 2: Rotor test geometry, D_a = 80 mm, D_i = 58 mm, D_{Rod} = 5,1 mm

Outlook

The conclusions from the investigations of the casting process of squirrel-cage rotors not only allow efficiency-oriented production of rotors. The implementation of a criterion function in a casting process simulation also aims to enable it to predict the magnetic properties of a rotor with sufficient accuracy, which will drastically reduce the experimental development effort required for asynchronous motors.

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Project partners:
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Funding:
DBU

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Fraunhofer IGCV I TUM UTG