Chair of Metal Forming and Casting
TUM School of Engineering and Design
Technical University of Munich

Casting technology approaches for increasing the efficiency of electric motors

Final Report

Motivation

Integral rotors for asynchronous motors are primarily manufactured using the pressure die-casting process. The efficiency of the rotors can be influenced or impaired, for example, by the temperature input, the casting pressure, and casting errors. Increased porosity of the short-circuit cage, for example, leads to a reduction in the conductor cross-sections and, thus, to an increase in electrical losses in the rotor. In pressure die casting, some pore volumes are in the double-digit percentage range.

For this reason, the Deutsche Bundesstiftung Umwelt (DBU) sponsored a project to investigate alternative casting methods for producing asynchronous rotors.

Procedure

Due to its potential for producing high-quality castings and its suitability for large-scale production, the low-pressure die-casting process was chosen and studied in the project for casting the rotors. With this, the small cross-sections in the rotor bars and large cross-sectional transitions from the bars to the short-circuit rings present a challenge.

A low-pressure casting machine was created at the institute for casting asynchronous rotors. Two different rotor geometries were employed, one of which facilitated magnetic measurements, allowing the investigation of the casting process‘s effect on the magnetic properties. The second rotor geometry, provided by AMK Motion and currently produced through pressure die casting, enables a direct comparison of the two casting methods.

Results

The casting process did not negatively impact the magnetic properties of the electrical steel sheets. Additionally, the proportion of defects in the rotors decreased from an average of 13 % to 1 % compared to the in-series produced pressure die-cast rotor. Through utilizing the alternative casting process, a noteworthy decrease in the defects of the rotors can be achieved.

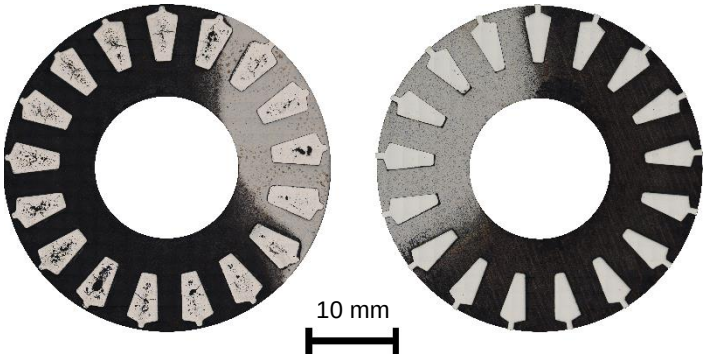

Fig. 1: Cross-section of the in series produced geometry through the middle of the bars of the short-circuit cage, left: pressure die-cast, right: low-pressure die-cast, photo: utg

Project run time

10/2019 to 08/2023

Funding

DBU, AZ 34988/01

Partnerships

Pinter Guss GmbH, RWP GmbH

Research done by

Georg Fuchs, Constantin Bauer