

The aim of this paper is to investigate the impact of material properties on performance and optimal geometry of high-speed drag-cup induction motor (IM). Preliminary analytical considerations are performed in order to envisage and demonstrate the effects of changes of material specific conductivity on the motor performance. Based on these conclusions, 2-D finite element method (FEM) motor model is used to obtain performance prediction, and to perform the optimization of rotor geometry and air gaps for three different rotor materials in order to find a solution with the best possible efficiency in defined operation region. Simulation results are then verified and corrected through 3-D FEM simulations. After this, thermal and mechanical properties of all the three optimal solutions are investigated using some analytical formulas and 3-D FEM simulations. Based on the performed analysis and the evaluation of electromagnetic, thermal, and mechanical properties, the best solution is selected. Finally, the prototype of machine which is electromagnetically similar to drag-cup IM is built and tested. Results are compared with the FEM simulations in order to verify the given optimization procedure.