Master thesis 30 hp
Examensarbete i Fysik, 30 hp –

Synthesis and optimization of two-dimensional composite materials for electric motors – cooperation between department of Physics, Umeå University and Scania, Södertälje

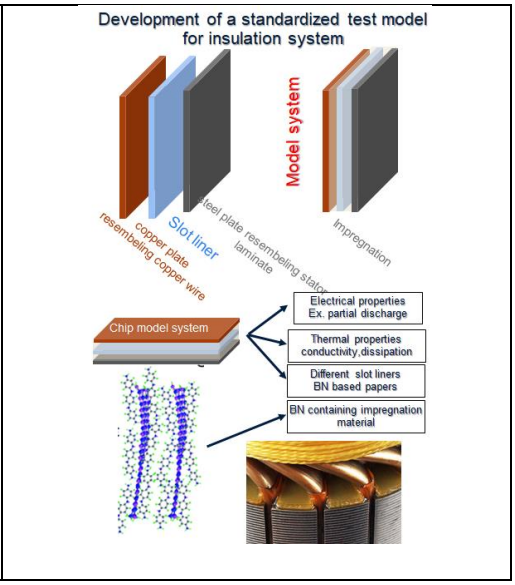
Background

The transition from automotive industry is accelerating towards electrically dominant vehicle systems which leads to higher-power duty cycles for electric-drive. One of the major barriers for achieving high power density in electric motors is effective heat transfer in order to avoid increased temperature within electric coils and permanent magnets. The problem originates from the interface between different components within electric motor, where air gaps with extremely low thermal conductivity obstruct the temperature propagation. Considerable issues arise at the interface of winding and stator and hence this gap needs to be filled by slot liner and then the whole slot with impregnation material, to push out any possible air bubble.

However, the low thermal conductivity of the common materials together with other physical property issues such as mechanical strength and flexibility still prevent to get even close to the optimum. Addition of high thermally conductive nanostructured additives, is recently considered as an industrial solution. However most of these additives possess high electrical conductivity as well, which can cause operation failure due to electric short cuts.

Aim

The aim of the project is to manufacture abd optimize the material for the slot liner and measure thermal conductivity and electrical conductivity of the sandwich structure, resembling the configuration in the electric motor utilized by Scania trucks (see figure to the left). The material should be made as composites with BN, or other suitable materials with high thermal conductivity and low electric conductivity as filler material in a polymer matrix. Optimization will be done with respect to thermal and electric properties as well as to mechanical properties. The material properties should be characterized on a system constructed in a parallel master thesis. The master thesis work is a collaboration between the "Nano for Energy group" (www.umunano.org) at department of physics at Umeå University and Scania at Södertälje.



Requirements

The "applicant" should have a background from masters of engineering in Physics or similar background. Experience from construction of test systems and programming in LabView is advantageous.

Contact

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