Paris Session 2022

Joint R & D Project on the Development of Electric Power Equipment using new Functional Insulating Materials

D1 Materials and emerging test techniques
Preferential subject 2: Materials for Electrotechnical Purposes
Question 2.09:

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- Is the reduction in the number of contributions on nanocomposites a sign of waning interest, acceptance that bulk processing remains a significant challenge or a reflection that these materials are moving towards real-world deployment? How close is the industry to deployment of nanocomposites?

<Answer>

- The insulation materials for large generators (epoxy-mica composite insulation) and small and medium-sized generators (enamel), which we have researched and developed in our project, are being developed on the premise of commercialization.
- Bulk processing, especially the method of controlling the aggregation of nanofillers during manufacturing, was an essential issue. Through trial and error, we are developing a technique to disperse the nanofillers at a certain level.

- Figure 1 shows a wire using nanofiller-containing enamel prototyped by Sumitomo Seika Chemicals, a member of this project, as an insulating material.
- This wire is manufactured in a factory-scale manufacturing facility, and a rotating machine using this wire is prototyped as shown in Figure 2 and its performance as a rotating machine is evaluated. The energy-saving effect and high partial discharge resistance by increasing the cross-sectional area of the conductor have been demonstrated, and it is expected to be commercialized within a few years.

Figure 1: Enamel wire containing nanofiller (nanoclay) in the insulating layer

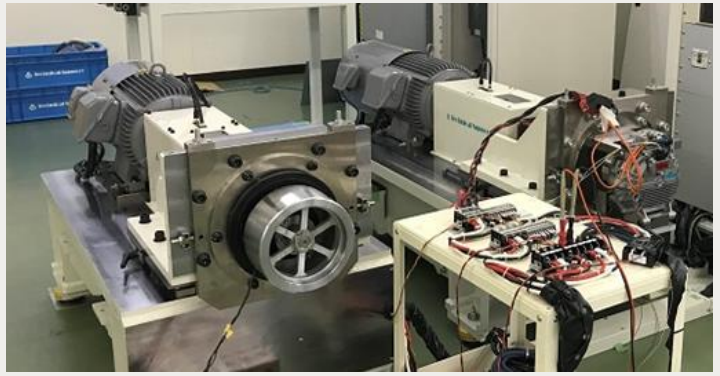

Figure 2: A prototype of a rotating machine using enamel wire containing nanofiller, which was installed at Shizuoka Institute of Science and Technology, a joint research member.

- Figure 3 shows cross-sectional view of enamel wires for small- and medium-sized rotating machines. By using a newly developed insulating material, it is possible to reduce the thickness of the insulating film, and the conductor resistance (copper loss) can be reduced by expanding the conductor cross-sectional area at the same outer diameter.
- Figure 4 shows the results of efficiency experiments using the prototype rotating machine shown in Figure 2. Although the value varies slightly depending on the rotation speed, the loss can be reduced by approximately 10% during steady operation.

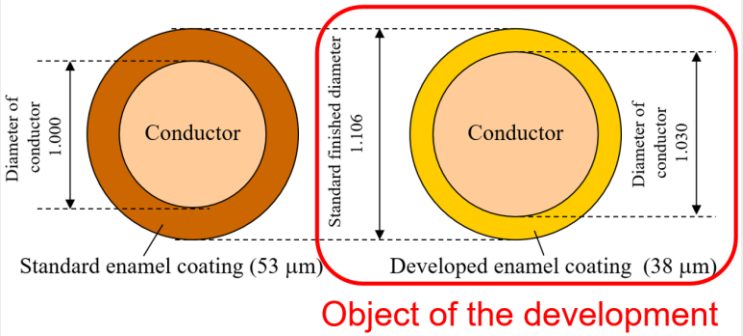

Figure 3: Cross-sectional view of enamel wires for small- and medium-sized rotating machines

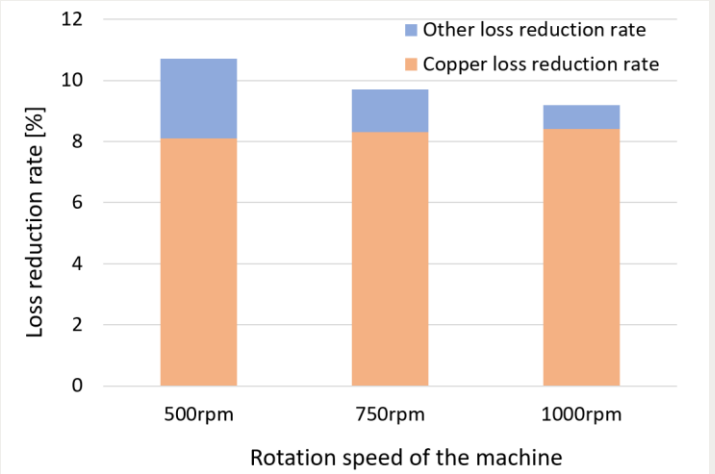

Figure 4: Results of efficiency experiments using prototype rotating machine