Recycling of large permanent magnets

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INTRODUCTION

The increase of wind turbines as a viable electric energy source generates a high demand on rare earth material in order to create permanent magnet (PM) wind turbines. The difficulties with mining and separating the rare earth metals used to create PM's leads to a high cost per kilogram. Therefore this project investigates the possibility to reuse the entire PM without having to destroy it first and adding some of it to the compound of a new batch of PM's. The focus is on the technical aspect on creating the PM's in such a way that makes them renewable for high end technical applications.

THEORY

In order to make it possible to reuse the PM's, a design has to be made on how to create these relatively large magnets with the unique feature of being renewable. The idea used in this project is to have a high segmentation of the large magnet. This is done to have the magnets as "flexible" as possible to be use in various generator designs since there are all kinds of PM generators on the market. And for these generators the size and shape of the magnets are rarely the same between different designs. With the high segmentation the magnets can be stacked close to any shape desired and then glued together and magnetized. In figure 1 a large magnet is seen together with the new design with high segmentation of magnets glued together. In the project the effects of the high segmentation are investigated in regards to the energy product generated from the magnets.

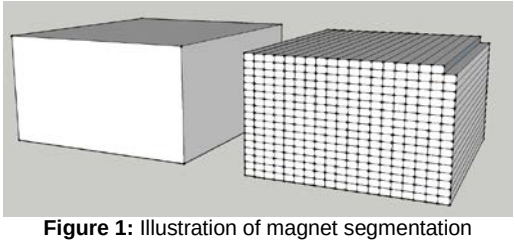

Figure 1: Illustration of magnet segmentation

METHODS

Throughout the project the electromagnetic equations are used but the actual calculation is done in simulations software because of the complexity of the equations. In order to validate the simulation models, a physical test setup has been made and the results from the simulations is compared to the results from the test setup. Also a technical investigation is made into the aspect of the available PM coatings in order to see the stress on the coating when subjecting it to high temperature for the later separations and demagnetization of the magnets that are glued together.

CONCLUSION

The project concludes on the effects of the high segmentation on large PM's for use in PM generators and the strain on the PM coating when expose to elevated temperatures.