

Merit Internship Report

MERIT 3rd

Department of Advanced Materials Science

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Period

2018.8.27 – 2018.9.21

Place

Shinano Kenshi Co., Ltd.

Introduction

Motors are the most basic driving device, and they are used in various aspects of life and economic activities. It is thought that the total power consumption by the motor exceeds 50% of the total power consumption, and it is indispensable to improve the efficiency of the motor in order to save energy. One of the energy losses of the motor is the iron loss generated from the magnetic field fluctuation of the iron core of the coil. Iron loss can be divided into hysteresis loss and eddy current loss. Since eddy current loss can be reduced by stacking thin steel plates, currently iron core is made by laminating electromagnetic steel sheets excellent in workability and magnetism. For fundamental innovation of performance it is necessary to consider the iron core of the new material. Since the iron-based amorphous material has no crystal grain, the hysteresis of magnetization is small, and because it forms a steel sheet by the roll quenching method, it becomes a very thin plate as compared with the electromagnetic steel plate. However, since the amorphous material is hard and fragile compared with the electromagnetic steel plate, not only there is a problem in workability but also wear of the die and the punch material for punching is intense. Therefore, when amorphous material is processed, there is a problem that the punch and die life become short.

In this internship, we investigated the reason why the punch life is shortened, and select the optimum long life punch material or surface processing for punching amorphous material.

Activity

A punching test was conducted by changing the punch material which is one of the factors to investigate the optimum conditions for punching amorphous material. The test pieces were amorphous (thickness 0.025 mm), and the magnetic steel sheets (20 A 1500 ,thickness 0.200 mm) were used as a comparative object. A die made of cemented carbide was prepared, and four kinds of punches including cemented carbide were prepared. A tensile strength tester manufactured by Shimazu was used as a testing machine and the following

examination was conducted.

- Investigation of mechanical properties of tensile tester

This tester can perform not only the tensile test but also the pressure test with high accuracy. Since it was a device shortly after introduction, it was necessary to know the behavior when punching the test piece in detail. The test was carried out using a carbide punch.

- Measurement of sample and punch material

In the punching process, not only the material of the punch but also various parameters such as the thickness of test specimen, surface dressing, roundness, clearance, etc. are involved. Measurement of the shape of the punched sample, observation of the punch surface, etc. were carried out. Based on these results, the most suitable punch material at present was selected. After selecting the punch material, we discussed the punch shape and punching method that can withstand mass production.

- The others

I took a tour of the site such as the development site of the main product, the tour in the factory, the assembly of the product, the assembly of the mold etc. I could also visit a different site from research and development, for studying measurement techniques, processing technology, thinking about product processing precision etc. In addition, there were opportunities to participate in part of the issues of contents different from this research.

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