LETTER TO EDITORS

Effect of Aging on the Maximum Permeability in Quenched Fe-Al alloys (ALPERM)

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"Alperm" is a high permeability iron-aluminium alloy containing 10 to 17 percent aluminium, which was discovered by Dr. H. Masumoto and the present author in 1939[1]. At present, the alloy containing 16 percent aluminium is widely used for the head of tape-recorders[2], especially, videotape-recorders, because of its high permeability[1], high electric resistance[3] and high abrasive resistance. This alloy is called Alfenol 16 in U.S.A.[4], Vacodur 16 in Germany and IU 16 in U.S.S.R.[5]

There is some belief that Alperm shows magnetic aging, resulting in a decrease of permeability, which is believed to happen after quenching. This is very important for practical applications. So, to confirm whether there is any aging effect or not in Alperm, the present author measured the change of magnetic properties n various Alperm alloys over a period of more than 2 years after quenching.

The specimens used are rings, 60 mm in outer diameter, 46 mm in inner diameter, and 0.5 mm thick, which were cut out from plates of iron-aluminium alloys containing 13.9, 14.7 and 15.1 percent aluminium, as prepared for our previous researches[1][3] on the effect of the heat treatment on the magnetic properties of the alloys. The specimens were heated at 1000°C for 1 hour in vacuum, cooled in the furnace to 600°C in the case of 13.9 percent aluminium alloy and to 570°C in the cace of 14.7 and 15.1 percent aluminium alloys, and then quenched in oil after being kept at the above tmperatures for 10 minutes. Four or five specimens of each alloy were stacked, and a magnetization coil and a search coil were wound on the stacks after they were covered by thin insulation tape. The measurements were made by the ballistic galvanometer method.

The results of measurements of the maximum permeability (μ_m) are shown in Fig. 1. As seen from the figure, there is no time change in μ_m in the alloy containing 13.9 percent of aluminium but for alloys containing 14.7 and 15.1 percent aluminium, μ_m increases with time after quenching, the increase being larger for the latter alloy. These changes of the maximum permeability may be caused by the relief of the elastic stress which was introduced by stacking ring specimens with plate surfaces curved slightly by quenching. In this connection, we may note that the elastic moduli of alloys containing more than 13 percent of aluminium becomes larger with an increase of aluminium content[6]. From the results mentiond above, we may conclude that very little or no magnetic aging exists in Alperm. But even if the change of permeability mentioned above might be due to the aging, it is clear that the aging increases the permeability, which is rather favourable to the application.

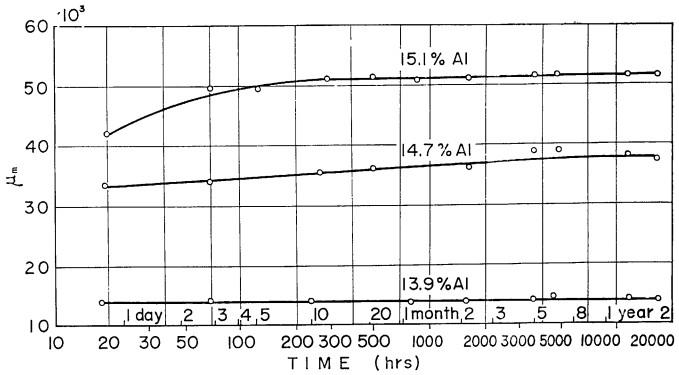

Fig. 1 Effect of aging on the maximium permeability in quenched Fe-Al alloys.

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