

Observation of magnetic domains in Fe-based amorphous alloys using polarized neutron magnetic imaging

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In commercially available Fe-based amorphous ribbons, so-called fish scales (FS), which are periodically shallow grooves spaced several millimeters apart, are formed on the surface of the ribbon in order to reduce iron loss. These FS are formed by controlling the casting conditions and vibrating the surface of the liquid metal as it solidifies. However, it has become clear that there is room for investigation into the iron loss reduction effect of FS[1]. Therefore, in order to verify the effectiveness of FS, the magnetic domain structure of Fe-based amorphous alloy ribbons with FS was confirmed three-dimensionally by polarized neutron magnetic imaging method. In samples with FS, refinement of magnetic domains has occurred, but the soft domain properties have not been significantly improved. The background to this is that there are few domain walls that can move smoothly even if domains are refined and the effect on reducing excess eddy loss is limited. When we attempted to refine the magnetic domains by adding laser processing to a smooth surface ribbon with low FS, excessive eddy current loss was significantly suppressed. This effect persists not only in single sheet samples but also in wound cores. In the future, we plan to proceed with polarized neutron magnetic imaging to verify the effectiveness of laser processing..

[1] N. Ito, H. Itagaki, M. Ohta, *J. Magn. Magn. Mater.* 564 (2022) 170168