

Industrialization and applications of high B FeSiBPCu nanocrystalline alloys with improved magnetic softness

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In 2009 the present authors, A Makino and H Men, have reported that the Fe-rich Fe-Si-B-P-Cu nanocrystalline alloys exhibit high saturation magnetic flux density ($B_s > 1.8$ T), low coercivity ($H_c < 10$ A/m) and low core losses by crystallizing a melt-spun hetero-amorphous phase(1,2). Since the finding, in the last 10 years the development of the manufacturing process or method of the material with low cost and seeking of suitable applications have been made by industry-academia collaboration. After overcoming many issues, recently the mass production of the materials with optimized alloy compositions has been successfully carried out, as shown in Figure1. The commercialized materials show high $B_s > 1.7$ T and extremely low H_c of 1A/m after optimized crystallizing process, which is almost the same as that of Finemet type alloy. The prototype motor, the toroidal power transformer and many kinds of magnetic devices using cores made of the nanocrystallized material ribbon exhibit remarkable improvement in energy consumption in comparison to those of Si-steel and the other soft magnetic materials cores.



Figure1. Mass production of the material by a single-roller melt-spinning in B Plus Co.,Ltd.

References:

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