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Magnetic Properties of $Fe_{73.5}Si_{13.5}B_9Cu_1Nb_3$ Alloy Crystallized in Nitriding-Atmosphere

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Amorphous $Fe_{73.5}Si_{13.5}B_9Cu_1Nb_3$ alloy was crystallized in nitriding atmosphere of mixture gas of ammonia and hydrogen. The crystallization at 823K showed the high electrical resistivity ranging from 570 to 620 μΩ-cm, which was higher level compared with nano-crystalline $Fe_{73.5}Si_{13.5}B_9Cu_1Nb_3$ alloy with a resistivity of about 113 μΩ-cm. Through the nitridation treatments, the amorphous alloy was transformed into nano-sized Fe_3Si crystals including iron nitrides such as γ´-Fe_4N phases. EPMA-concentration depth profiles confirmed an existence of nitrogen-rich region on the surface of the alloy ribbon, leading to the preferential formation of γ´-Fe_4N phase. The formation of γ´-Fe_4N phase leaded to an increase of the resistivity, provided stable permeability and a low core loss at high frequency.

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