Structural Analyses for $Fe_{85.2}Si_1B_9P_4Cu_{0.8}$ Nanocrystalline Soft Magnetic Alloy by XAFS and TEM

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New soft magnetic alloys $Fe_{85-86}Si_{1-2}B_8P_4Cu_1$ (NANOMET) developed by Makino *et al*[1] exhibit low *Hc*∼5.8 A/m and low magnetic core loss (*W*) as well as high *Bs*∼1.8 T. Because their soft magnetic properties depend significantly on the grain refining of α-Fe precipitates, it is quite important to understand the nanocrystallization kinetics of NANOMET. In this work, the structural change during the nanocrystallization of $Fe_{85.2}Si_1B_9P_4Cu_{0.8}$ alloy is investigated by means of X-ray absorption fine structure (XAFS) and transmission electron microscope (TEM). The transformation from amorphous structure starts below the 1st crystallization temperature and a primary crystalline phase α-Fe crystallites begin heterogeneously nearby fcc Cu-clusters. A short range order of a bcc structure develops before the formation of the long range bcc structure and transforms entirely into bcc structure at optimum heating condition. Close relationships between the local structure change around Cu and progress of bcc-Fe precipitation are confirmed by XAFS and TEM observatn.

References:

[1] A. Makino, IEEE Trans. Magn., vol. 48, pp. 1331-1335, Apr. 2012.