Influence of P substitution for B on the structure and properties of nanocrystalline $Fe_{73.5}Si_{15.5}Nb_3Cu_1B_{7-x}P_x$ alloys

Chau N., Luong N.H., Chien N.X., Thanh P.Q., Van Vu L.

Center for Materials Science, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam; Department of Solid State Physics, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam

Abstract: Amorphous ribbons of $Fe_{73.5}Si_{15.5}Nb_3Cu_1B_{7-x}P_x$ (x=0,1,2,3, and 4) have been prepared by rapid cooling on a single copper wheel. The crystallization of ?-Fe(Si) phase is independent of the P content in the alloys. Based on Kissinger plots, the activation crystallization energies are determined. The size of the nanoparticles crystallized on an amorphous matrix in heat-treated ribbons is found to be 10-12nm. The crystallization fraction is determined by using thermal-analysis equipment and we show that after 30min annealing, this fraction is over 80%. The thermomagnetic curves measured between room temperature and 1000K revealed clearly two magnetic phases: an amorphous phase at low temperatures and a crystalline one at high temperatures.

Author Keywords: Crystallization kinetics; Grain size; Nanocrystalline materials; Soft ferromagnetism

Index Keywords: Crystallization; Differential scanning calorimetry; Grain size and shape; Iron alloys; Magnetic anisotropy; Particle size analysis; Structure (composition); X ray diffraction analysis; Rapid cooling; Nanostructured materials

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Correspondence Address: Chau, N.; Center for Materials Science, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam; email: chau@cms.edu.vn

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Authors with affiliations:

1. Chau, N., Center for Materials Science, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam
2. Luong, N.H., Center for Materials Science, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam
3. Chien, N.X., Center for Materials Science, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam
4. Thanh, P.Q., Department of Solid State Physics, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam
5. Van Vu, L., Department of Solid State Physics, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam
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