Tailored soft-magnetic properties in Fe-based amorphous alloy by nucleation and growth controlled annealing

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NANOMET [1] exhibits high $B_s$ of exceeding 1.8 T and low $H_c$ of less than 10 A/m. These good soft magnetic properties are optimized by grain-size controlled annealing. Sharma has already pointed out that many nuclei formation and growth suppression by rapid heating is effective to obtain a fine grain structure, leading to extra low $H_c$ [2]. In general, nano-crystallization of amorphous alloy by annealing can be comprehensible on the framework of classical nucleation theory. In this paper, we intend to figure out the overall feature of nano-crystallization in Fe-based amorphous alloy by use of TEM image analysis. As a result, it was clarified that the as-quenched amorphous alloy contained $10^{22}$ /m$^3$ orders of magnitude pre-existing nuclei and growth of these nuclei causes course grain structure by annealing at low heating rate. Furthermore, processable annealing for user will be quantitatively discussed.

References: