

Magnetic domain structure and evolution behaviour of directionally solidified Tb-Dy-Fe alloy with high magnetic fields

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The magnetic domain structure of magnetostrictive materials can intuitively reflect the change of magnetostrictive properties during the magnetization process [1-3]. Therefore, we investigated the effect of high magnetic field on the magnetostrictive properties, static magnetic domain structure, and dynamic magnetic domain evolution of directionally solidified Tb-Dy-Fe alloys, as well as the intrinsic connection between high magnetic field and domain structure. First, we prepared the directionally solidified Tb-Dy-Fe alloys with a high magnetic field and characterized their magnetic domain structures by Magneto-optical Kerr microscope. The observed domain patterns variation with magnetic field of the cross-section surface are shown in Fig. 1. Two distinct structures which include the typical striped magnetic domain and labyrinthine domain are observed in all directionally solidified samples with 0 T and 6 T magnetic fields. When the driving magnetic field increases from 0 mT to 1200 mT, both the domain wall annihilation and magnetic domain merging appear in the samples prepared with 0 T and 6 T magnetic fields. With a 1200 mT driving magnetic field, the striped domains in the sample prepared with 0 T magnetic field almost disappeared, but the point-like labyrinth domains could not reach the saturation state; but the magnetic domains in the sample prepared with 6 T magnetic field almost completely disappeared, which indicated magnetic domains reached saturation state. Based on the above results, under the same driving magnetic field, the magnetic domain of the sample prepared with 6 T magnetic field is more easily magnetized and reaches the saturation state.

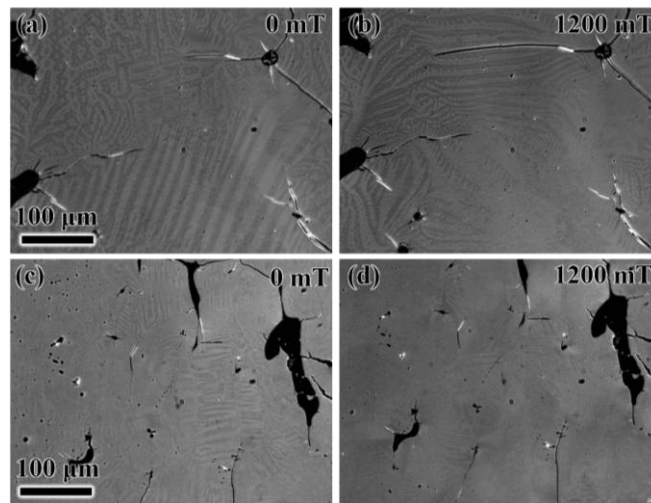


Fig. 1 Magnetic domain morphologies of directional solidified Tb-Dy-Fe alloy with different magnetic fields: (a) and (b) 0 T; (c) and (d) 6 T

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