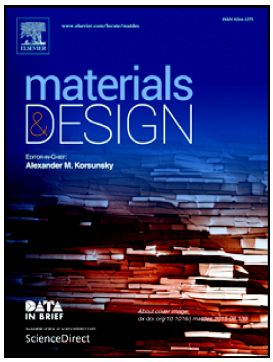

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Premartensite serving as an intermediary state between strain glass and martensite in ferromagnetic Ni-Fe-Mn-Ga

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Abstract

Previous investigations indicate that the two intrinsically different states, i.e., strain glass and premartensite in ferromagnetic Ni-Mn-Ga based system share some similarities in their transforming properties, such as nano-domain structure, elastic anomaly and temperature-induced transition to martensite. This indicates that the two states are possibly related with each other. However, the relationship between them is unclear so far. To explore this problem, we investigated the transforming behaviors of the ferromagnetic $Ni_{55-x}Fe_xMn_{20}Ga_{25}$ (x=4~14) system. It was found that the transforming route of this system changes greatly with increasing Fe content. We also observed that the strain glass transforms into premartensitic state upon cooling, which is called spontaneous strain glass to premartensite transition. The local structure of strain glass is similar to that of premartensite. Moreover, a strain glass phase diagram of the Ni-Fe-Mn-Ga system was constructed, which reveals that the premartensite servers as an intermediary state between strain glass and martensite. With increasing Fe doping, the system changes from the martensite (long-range-ordered strain state with large spontaneous strain) into the premartensite (long-range-ordered strain state with small spontaneous strain) at first, and then the strain glass (short-range-ordered strain state with small local strain) is derived from premartensite by further doping Fe.

Keywords: Ferromagnetic shape memory alloy; Martensitic transformation; Premartensite; Martensite; Strain glass