Nanocomposites and nanomaterials

Ultrafine grained structure of Fe-Ni-C austenitic alloy formed by phase hardening

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Grained structure of reverted austenite after f.c.c. – b.c.c. – f.c.c. martensitic transformations was studied by X-ray diffraction method. Multiplication of crystallographic orientations of initial austenite in accordance with oriental relationships between austenite and martensite (nanograin refinement) occurred in austenite single crystalline alloy after reversed b.c.c. – f.c.c. transformation of diffusion character. As result of this process the complicated grain structure of reverted austenite was formed in Fe – 22.7 wt. % Ni – 0.58 wt. % C alloy. The features of grain structure are: absence of inner stresses, less half-width of diffraction reflexes of the reverted austenite, wide range of grain sizes up to nanoscale level, significant grains inhomogeneity of nickel concentration.

Volume fraction of nanoscale crystals defines by the action of different factors – chemical content of metastable alloys, heating rate in the interval of reverse b.c.c. – f.c.c. transformation, a number of f.c.c. – b.c.c. – f.c.c. transformation cycles (degree of phase hardening), diffusion mobility of interstitial and substitution atoms and accumulation of structure defects. Intensity of reflexes of the reverted austenite differs by an order of magnitude and more, i.e. the quantity of grains with different orientation was significantly differed. The most intensive reflexes were close in orientation with the reflexes of austenite which was twinned according to initial austenite. Some reflexes have been blurred that indicates the thin-plate grains of nanoscale level formation.