APPLICATION OF BARKHAUSEN NOISE FOR ASSESSMENTS OF DAMAGE IN FERROMAGNETIC MATERIALS WITH NEGATIVE MAGNETOCRYSTALLINE ANISOTROPY CONSTANT

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Magnetic Barkhausen noise (MBN) is the result of the irreversible movement of magnetic domain walls during a magnetisation cycle [1]. Domain walls are pinned by microstructural barriers and released abruptly in the changing magnetic field. Among many kinds of microstructural barriers breaking domain wall movement the voids [2], grain boundaries, precipitates and dislocations [1] can be distinguished.

Magnetic Barkhausen effect is a surface phenomenon occurring in ferromagnetic materials. There are two types of ferromagnetic materials – one with positive (mainly steels and irons with ferrite, bainite or martensite microstructural phase) and the other with negative magnetocrystalline anisotropy constant (mainly nickel and cobalt). The Barkhausen noise of these two types of materials behaves differently under the influence of mechanical loads.

The MBN method is often successfully used to control the uniformity of the microstructure, heat treatment and hardness of the ferromagnetic materials. It is also suitable in providing a knowledge concerning microstructural degradation, grain size, plastic flow, texture [3] as well as mechanical properties [4]. It should be mentioned however, that majority applications of the MBN method was limited to ferromagnetic materials with a positive magnetocrystalline anisotropy constant.

The aim of this work is an attempt for evaluation of degradation level of nickel plate – a ferromagnetic material with a negative magnetocrystalline anisotropy constant. The plain specimens of nickel were subjected to creep. The process was interrupted for a range of the selected time periods in order to achieve specimens with an increasing level of creep strain. After each prestraining test the specimens were investigated using the MBN method. Mutual relationships between creep prestrain level and parameters coming from the rms Barkhausen noise envelopes were elaborated.

References

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