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A study of the mechanism of delamination fracture in bainitic magnetic yoke steel

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Abstract

In this paper, we describe an experimental tension test of bainitic magnetic yoke steel RST330. This experiment simulates the ultimate stress condition on the magnetic yoke in the high-speed rotor of a large hydro-generator. During tensile stress testing, a delamination fracture developed at a point near ½ the thickness of the yoke cross section. The delamination fracture mechanism was investigated using an optical microscope, scanning electron microscope, wavelength dispersive spectrometer, X-ray diffractometer, electron backscatter diffraction and other methodologies. We determined that the delamination was a classic cleavage fracture. The phosphorus segregation bands in both grain boundaries and the interior of the grains increased the brittleness of the core of the cross section where the tensile fracture occurred, facilitating the cleavage fracture. The increased texture intensity on the {001} easy cleavage face also increased the likelihood of cleavage fracture at the half thickness of the cross section of the specimen. During tension test, the maximum stress concentration in the thickness direction occurred at the center of thickness. The delamination fracture propagated from and along that center area.

Keywords: delamination fracture; cleavage; phosphorus segregation; stress concentration

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