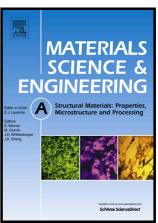
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ACCEPTED MANUSCRIPT

Measurement and tailoring of residual stress in expanded austenite on

austenitic stainless steel

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Abstract

Expanded austenite on stainless steel with a high interstitial nitrogen content is characterized by

elasto-plastic accommodation of the large composition-induced lattice expansion leading to huge

compressive residual stress. The elasto-plastic accommodation as well as the (steep)

concentration profile has implications for the measurement strategy to determine lattice strains

and associated residual stresses with X-ray diffraction. Lattice strain measurements were

performed on nitrided as well as subsequently de-nitrided expanded austenite on AISI 316L

stainless steel, for various grazing incidence angles. It is demonstrated that keeping the

information depth constant by choosing appropriate combinations of grazing incidence and tilt

angle leads to reliable results for the 111 reflection, while the 200 reflection should be avoided.

Further, it is shown for the first time that the residual stresses in expanded austenite can be

tailored by de-nitriding after nitriding, such that a condition of virtually zero stress at the surface

is obtained.

Keywords: X-ray stress measurement; expanded austenite; nitrogen; stainless steel; residual stress

1. Introduction

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