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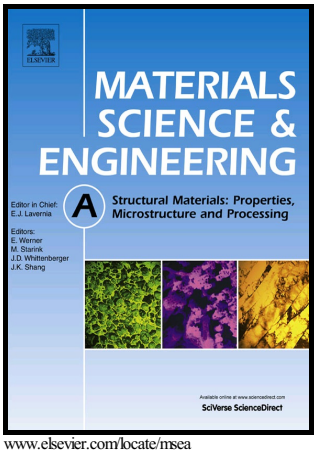

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Enhanced quasi-static and dynamic shear properties by heterogeneous gradient and lamella structures in 301 stainless steels

Junxia Xing[a,b], Fuping Yuan[a,b*], Xiaolei Wu[a,b]

[a]State Key Laboratory of Nonlinear Mechanics, Institute of Mechanics, Chinese Academy of Science, No.15, North 4th Ring, West Road, Beijing 100190, People's Republic of China

[b]School of Engineering Science, University of Chinese Academy of Sciences, Beijing 100190, People's Republic of China

xingjunxia@imech.ac.cn
fpyuan@lnm.imech.ac.cn
xlwu@imech.ac.cn

[*]Corresponding author: Tel.: 86 10 82544409, fax, 86 10 82543977

Abstract

In the present study, quasi-static and dynamic shear response of 301 stainless steel (SS) with gradient structure (GS) and heterogeneous lamella structure (HLS) were investigated by uniaxial tensile tests and Hopkinson-bar tests with hat-shaped specimens. The 301 SS with GS and HLS show a good combination of strength and ductility under quasi-static tensile tests, which is due to the back stress hardening for heterogeneous structures. Before the formation of adiabatic shear band (ASB), the dynamic shear response of 301 SS with coarse-grained (CG) austenitic structure shows a strong linear hardening stage and a plateau stage, which are due to the martensite transformation and the continuous deformation through strain partitioning between different phases, respectively. For 301 SS with CG austenitic structure, the grain size was observed to significantly refined in the ASB, while the reverse phase transformation occurs and the austenite phase increases significantly again in the ASB with increasing shear displacement, resulting in a hardness valley in the ASB at the shear displacement of 2.0 mm. The GS and HLS show excellent dynamic shear properties, this could be due to the back stress hardening for either macroscopically or