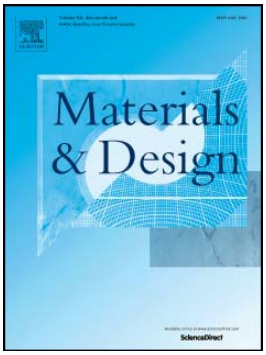

Description of stress–strain curves for stainless steel alloys

I. Arrayago, E. Real, L. Gardner

PII: S0264-1275(15)30250-1
DOI: doi: 10.1016/j.matdes.2015.08.001
Reference: JMADE 409

To appear in:

Received date: 6 November 2014
Revised date: 28 July 2015
Accepted date: 1 August 2015

Please cite this article as: I. Arrayago, E. Real, L. Gardner, Description of stress–strain curves for stainless steel alloys, (2015), doi: 10.1016/j.matdes.2015.08.001

Description of stress-strain curves for stainless steel alloys

I. Arrayago[a], E. Real[a], L. Gardner[b]

[a] Department of Construction Engineering, Jordi Girona 1-3, Barcelona 08034, Universitat Politècnica de Catalunya, Barcelona, Spain
E-mails: itsaso.arrayago@upc.edu, esther.real@upc.edu

[b] Department of Civil Engineering, Skempton Building, South Kensington Campus Imperial College London, London SW7 2AZ, UK
E-mail: leroy.gardner@imperial.ac.uk

Corresponding author: I. Arrayago, C/ Jordi Girona 1-3, C1 Building (207), Barcelona 08034, Spain. Tel: +34 934054156; Fax: +34 934054135, e-mail: itsaso.arrayago@upc.edu

ABSTRACT

There is a wide variety of stainless steel alloys, but all are characterized by a rounded stress-strain response with no sharply defined yield point. This behaviour can be represented analytically by different material models, the most popular of which are based on the Ramberg-Osgood formulations or extensions thereof. The degree of roundedness, the level of strain hardening, the strain at ultimate stress and the ductility at fracture of the material all vary between grades, and need to be suitably captured for an accurate representation of the material to be achieved. The aim of the present study is to provide values and predictive expressions for the key parameters in existing stainless steel material models based on the analysis of a comprehensive experimental database. The database comprises experimental stress-strain curves collected from the literature, supplemented by some tensile tests on austenitic, ferritic and duplex stainless steel coupons conducted herein. It covers a range of stainless steel alloys, annealed and cold-worked material, and data from the rolling and transverse directions. In total, more than 600 measured stress-strain curves have been collected from 15 international research groups. Each curve from the database has been analysed in order to obtain the key material parameters through a curve fitting process based on least squares adjustment techniques. These parameter values have been compared to those calculated from existing predictive models, the