A novel experimental method for assessment of intrinsic functional and structural fatigue of pseudoelastic NiTi wires

S.M. Jaureguizahar, M.D. Chapetti, A. Yawny

PII: S0142-1123(18)30268-8
DOI: https://doi.org/10.1016/j.ijfatigue.2018.06.034
Reference: JIJF 4738

To appear in: *International Journal of Fatigue*

Received Date: 26 January 2018
Revised Date: 16 June 2018
Accepted Date: 21 June 2018

Please cite this article as: Jaureguizahar, S.M., Chapetti, M.D., Yawny, A., A novel experimental method for assessment of intrinsic functional and structural fatigue of pseudoelastic NiTi wires, *International Journal of Fatigue* (2018), doi: https://doi.org/10.1016/j.ijfatigue.2018.06.034

A novel experimental method for assessment of intrinsic functional and structural fatigue of pseudoelastic NiTi wires

S. M. Jaureguizahar[a], M. D. Chapetti[a] and A. Yawny[b]

[a] INTEMA (CONICET-Universidad Nacional de Mar del Plata), Mar del Plata (7600), Argentina

[b] División Física de Metales, Centro Atómico Bariloche, CNEA-CONICET, S.C. Bariloche (8400), Argentina

Phone number: +540294154725657

Email: sebastianjaureguizahar@fi.mdp.edu.ar

Highlights:

- A novel method for studying fatigue life of pseudoelastic NiTi wires is proposed
- The spurious early failures induced in the gripping area are eliminated
- The method allows analyzing of functional and structural fatigue of a NiTi wire
- Longer fatigue lives have been obtained compared to traditional gripping methods

A B S T R A C T

A new experimental method for characterizing intrinsic uniaxial pull-pull pseudoelastic fatigue life of commercial NiTi wires is proposed. It consists in the generation of a virtual dog-boned shaped specimen combined with the use of snubbing type of gripping action in order to completely eliminate earlier failures induced by grip-sample interactions. The generation of a virtual dog-boned specimen is based on the localized character of the stress induced martensitic transformation and the evolution of the transformation stresses with further cycling. Reduced pseudoelastic cycles are performed to evaluate functional and structural fatigue with this method. Consistent longer fatigue lives have been obtained compared to traditional gripping methods with fractures occurring inside the region of interest. The present study clearly points to the role of the stress induced transformation in determining the fatigue life. This treatment of the structural fatigue considerable departs from classical approaches but takes into account essential facts like the localized character of the stress induced transformation, the heat effects associated with the first order solid to solid martensitic transformation and its impact on the critical transformation stresses.

Keywords: Shape memory alloys; Fatigue test methods; Martensitic transformations; Pseudoelasticity