Characterization of the tension-compression behavior of the Fe-30Mn-6Si-5Cr Shape Memory Alloy

Malek Megdiche*[1], Guillaume Helbert†[2], Shabnam Arbab Chirani[3], and Tarak Bouraoui[4]

[1]Laboratoire de Génie Mécanique (LGM) – Av. Ibn ElJazzar, Monastir, TUNISIE, Tunisie
[2]Institut de Recherche Dupuy de Lôme (IRDL - UMR CNRS 6027) – Ecole Nationale d'Ingénieurs de Brest (ENIB) – France
[3]Institut de Recherche Dupuy de Lôme (IRDL FRE CNRS 3744) – Ecole Nationale d'Ingénieurs de Brest (ENIB) – 945 Avenue Technopole, 29280 Plouzané, France
[4]Laboratoire de Génie Mécanique de Monastir (LGM) – Rue Ibn El Jazzar - Monastir - 5000, Monastir, Tunisie, Tunisie

Résumé

Iron based shape memory alloys are known for their special thermomechanical properties that can be exploited in innovative industrial applications such as high damping capacity systems. This great potential can't be industrially exploited without the good knowledge and control of thermomechanical behavior under different conditions and in particular under different loading paths (tension, compression).In this paper, the tension and compression behavior of the Fe-30Mn-6Si-5Cr shape memory alloy has been studied under several conditions in order to bring out an optimization for damping purposes. In this context, cylindrical specimen cut by wire EDM (Electrical Discharge Machining) were tested using a tensile machine under several parameters. Temperature effect was studied from ambient to 200∘C. Different microstructural states were investigated: purely austenitic state and biphased states (austenite + stress induced and/or thermal martensite). Furthermore, tension-compression cycles were realized at different loading rates for better behavior apprehension and specially the tension-compression asymmetry behavior. Finally, a specific heat treatment has been performed to ensure shape memory effect by enhancing martensitic transformation and improving martensitic transformation temperature points.

Mots-Clés: Iron Based Shape Memory Alloys, Compression behavior, Tension, Compression Asymmetry, Heat Treatment

*Auteur correspondant: malekmegdiche@gmail.com
†Intervenant