BEHAVIOUR OF INCONEL 718 AEROSPACE ALLOY THIN SHEETS UNDER IN-PLANE TENSION-COMPRESSION

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The nickel-based superalloy Inconel 718 is one of the most widely applied alloys in the aerospace industry, commonly used in critical parts of aircraft engines and rocket thrusters for various components, like compressor blades, vanes, diffusers, shafts and support cases. The work reported herein aims at deepening the knowledge regarding large deformation tension-compression cycling behaviour, especially the effect of the nonlinear kinematic hardening on the plastic anisotropy parameters for cold-rolled thin sheets made of this alloy. To avoid effects of the buckling phenomenon during compression carried out on specimens with significant differences of length-to-thickness ratio, all experimental investigations were performed using a special, recently patented Anti-buckling Fixture, which allows studies in the range of advanced plastic straining and considerable work-hardening, both in tension and compression directions.

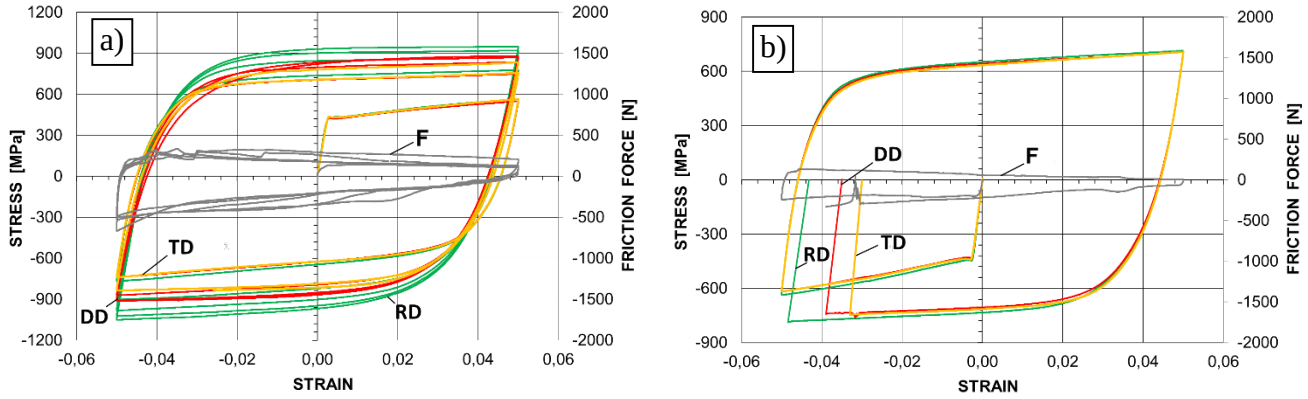

Fig. 1. Tension-compression cycling loops of the Inc718 alloy and friction force (F) variation: start in tension a), start in compression b) direction.

The tension-compression tests were carried out on specimens with nominal thickness 1 mm, cut out from the sheet in three directions: RD, DD, TD (0, 45 and 90 degrees, respectively). Cyclic loading was performed under displacement control with the strain rate of 0.025 mm/s. A special set-up for friction force measurements, calibrated in the range of ±2 kN, was applied. In the first type of tests, shown in Fig.1a (tension-compression), 3 cycles within the strain range ±0.05 were executed, starting in tension. The cycles were finished with the force equal 0. In the second type of tests, shown in Fig.1b, single cycles within a strain range ±0.05 were executed, however, starting in compression direction. Results of test show the effect of strain-hardening stagnation observed after the change of loading direction, especially after the first cycle.

Acknowledgement. The research reported herein was partly supported by a grant from the National Centre for Research and Development (No. PBS3/A5/47/2015).