

ON THE IMPROVEMENT OF THE FATIGUE BEHAVIOUR OF AUSTENITIC STAINLESS STEEL DUE TO SURFACE RESIDUAL STRESSES PRODUCED BY LOW TEMPERATURE CARBURIZING

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The attempts made in recent years to engineer the surface of austenitic stainless steels to improve their hardness and tribological properties, without deteriorating their corrosion resistance, had as a secondary effect the modification of the fatigue properties of those materials. In fact, austenitic stainless steels have a low hardness and consequently poor wear resistance.

A possibility to improve these properties is given by low temperature carburizing, that involves diffusion of large quantities of C atoms into the material at a diffusion temperature below 450 °C (to prevent the formation of undesired chromium carbides). Due to the low temperature, the treatment requires a long diffusion time of about 100 h to achieve a carburised layer of few tens of μm .

Several researchers observed a marked improvement in fatigue life due to these treatments [1-5]. In [1, 2] the authors measure residual stress at the surface by X-ray diffraction and find peaks of -1500 MPa. Using the same method in [3, 4] the maximum value of measured residual stresses exceeds -2000 MPa.

The fatigue fracture nucleation sites are preferably located in plain specimens at the interface between the treated and not treated zones, while in notched specimens or specimens with surface defects fracture starts from the surface.

Aim of the work is to set up a phenomenological model of the fatigue behaviour of these materials in order to predict the improvement of their fatigue life due to the presence of such high residual stresses.

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