

Near surface stress gradients analysis by GIXRD on laser shocked 6056 aluminium alloy samples

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Abstract

Laser shock peening (LSP) can introduce a compressive stress profile for improving the materials' surface mechanic properties. 6065 Aluminium alloy is widely used in the aeronautic components. The surface performances of the components are related directly to the surface activity and surface corrosion properties which are influenced by the near-surface stress gradient. So, the determination of residual stress dues to LSP near the surface layer of 6065 alloy is very important for the surface strengthen and for surface activity. Pseudo-grazing incidence X-ray diffraction (GIXRD) is a non-destructive method and can be used to evaluate the residual stress gradient below the surface at very shallow depths of a few micrometers according to the different materials. The experiments were carried by two GIXRD methods: multi-reflection method using the various crystallographic $\{hkl\}$ family planes and $\sin^2\psi^*$ method using the various corrected angles ψ^* , ϕ^* , Ω^* with only one crystallographic family. The purpose of this study is to quantify the stress gradient of 6056 aluminium alloy from surface up to 10 micrometer by these two GIXRD methods, then to compare the results for the determination of their limits.

Keywords: Residual stress; GIXRD; 6065 aluminium alloy ; Laser shock peening; multi-reflection; $\sin^2\psi^*$ method