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Microstructural Investigation and Fatigue Damage Quantification of Anisotropic Behavior in AA2017 Aluminum Alloy under Cyclic Loading

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Abstract : This paper reports on experimental investigations concerning the underlying reasons for the anisotropic behavior observed during the cyclic loading of AA2017 aluminum alloy. Initially, we quantified the evolution of fatigue damage resulting from controlled proportional cyclic loadings along the axial and shear directions. Our primary objective at this stage was to verify the anisotropic mechanical behavior recently observed. To accomplish this, we utilized various models of fatigue damage quantification and conducted a comparative study of the obtained results. Our analysis confirmed the anisotropic nature of the material under investigation. In the subsequent step, we performed microstructural investigations aimed at understanding the origins of the anisotropic mechanical behavior. To this end, we utilized scanning electron microscopy to examine the phases and precipitates in both the transversal and longitudinal sections. Our findings indicate that the structure and morphology of these entities are responsible for the anisotropic behavior observed in the aluminum alloy. Furthermore, results obtained from Kikuchi diagrams, pole figures, and inverse pole figures have corroborated these conclusions. These findings demonstrate significant differences in the crystallographic texture of the material.

Keywords : microstructural investigation, fatigue damage quantification, anisotropic behavior, AA2017 aluminum alloy, cyclic loading, crystallographic texture, scanning electron microscopy
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