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Endurance and Damage in Fatigue of Symmetrical Configuration 2P-2V-2P Perlon-Glass-Acrylic Composite Laminates of Orthopaedic Use

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Abstract: In this paper, an experimental characterization of fatigue behaviour on prismatic specimens of a symmetrical laminated composite material perlon- glass- acrylique 2P-2V-2P for orthopaedic use is conducted. Cyclic repeated solicitation is employed corresponding to applied minimum stress ?min equal zero. The various loading levels imposed on the specimens are 80%, 70%, 60%, 55%, 45%, 35% and 25% of the value of the static failure strength measured in flexure. A significant scatter characterizes the results of material fatigue lifetime. That is the consequence of the heterogeneity of the material structure. The scattered phenomenon prevents any prediction of the lifetime with a good probability using Wohler equation. This enables defining a constant degradation rate by 10% cycle decade. The microstructure morphology study through microscopic observations is also discussed and analyzed. The damage state in fatigue is characterized by a combination of density and orientation of micro-cracks. This damage is mainly due to mechanisms complexity of matrix micro-cracking, inter facial exfoliation, debonding and delamination. The damage evolution stages in the case of cyclic loading have the same nature than those found in static loading but have different chronology and scale

Keywords : perlon, acrylic, Orthopaedic, fatigue, Scatter