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In-body corrosion fatigue failure of a stainless steel orthopaedic implant with a rare collection of different damage mechanisms

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Abstract

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A stainless steel orthopaedic (femoral) implant was examined, which had fractured inside a patient's thigh. It had been in his leg for almost two years, with no problem in the bone reconstruction process. The plate had apparently fractured during the first few months, when the bone had not been reconstructed completely. Different investigations such as visual assessments, hardness testing, stereoscopy, metallography, quantometry, SEM fractography and EDS microanalysis were performed in order to analyze the failure mechanism and its cause(s). Different damages were observed such as crevice corrosion pitting, initiation of cracks from these pits, intergranular surface cracking inside the crevice, and also SCC-like branched cracks. But, the main failure mechanism was determined to be corrosion fatigue assisted by crevice corrosion. © 2006 Elsevier Ltd. All rights reserved.

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Corrosion fatigue; Crevice corrosion; Failure analysis; Stainless steel orthopaedic implant

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Engineering controlled terms: Corrosion fatigue; Crack initiation; Cracks; Fractography; Hardness; Implants (surgical); Metallographic microstructure; Orthopedics; Pitting

Engineering uncontrolled terms: Crevice corrosion; Intergranular surface cracking; Orthopaedic implant

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