The 2nd International Conference on welding, nondestructive testing and the industry of materials and alloys (ICWNDT-MI'10)

2010

PROBABILISTIC MODEL FOR PITTING CORROSION AND FATIGUE LIFE ESTIMATION FOR TURBINE BLADES

Y. ASSOUL, V. SIJACKI, N. BACHA, D. SEMMAR

Abstract : Service conditions of turbine blades are very complicated because of the mechanical loadings and severe environmental conditions of the aggressive and hot fluid stream. The pressure and temperature variations provoke mechanical load variation at the start up and the shut down and could aggravated the blades dynamics proprieties in the rotating system. Different corrosion mechanisms could be developed in turbine blades, in according to the operational environment, but it has been shown by several updated studies that dominant failure mechanisms in turbine blades is fatigue crack progression, initiated at pitting corrosion defect. This failure mechanism is a complex electrochemical and mechanical one. To prevent the occurrence of an undesirable failure, the presented research, aims to find a procedure to estimate the life and the damage evolution in studied structural parts, and to schedule optimal time to reaper with convenient repairs actions. By considering the very large dispersion of several parameters and the not exactly well define models yet, the one that is developed in this study is the probabilistic damage tolerance model. The model is taking in account, that most parameters are likely random, and trying to found the best probabilistic evaluation of failure occurring. Several works in engineering sciences are concerned with the degree of knowledge on statistical distributions of the model parameters, to limit the randomness. Some of them are mentioned in this work. The model studied is the conceptual model with seven stages, the pitting initiation, the crack growth, transition from pit to crack growth, short crack growth, transition from the short crack growth to long crack growth, long crack growth and finally the fracture. This complex model comport several not well defined physical concepts, and some better known entities. This mechanistic model is embedded to a probability philosophy, to estimate the probability of failure according to well known classical deterministic models

Keywords : soudage, cnd, l'Industrie des Métaux