EFFECTS OF STRESS CONCENTRATION ON FATIGUE CRACK INITIATION AND FAILURE IN AIR AND CORROSIVE ENVIRONMENT

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In this study, the first part of the experimental work is devoted to the determination of the endurance limits (σ_{EL}) of smooth specimens in air and 3.5% NaCl solution. The materials chosen for this research are aluminum 7075-T651, aluminum 6061-T651 and 4140 steel. The endurance limits were estimated using four methods such as; 10^7 cycles extrapolation using log-log and semi-log scale, $1/N_f$ method, and the Locati method. The first and second methods involved extrapolation of S-N curves to 10^7 cycles. While in the third method, the S-N data are re-plotted using $1/N_f$ as an abscissa to determine the endurance limit at $1/N_f = 0$ assuming N_f is infinity. The fourth method utilizes a step test loading of a single specimen till failure. The data collected from the step loading method, the linear cumulative life fraction $\sum \Delta N_i / N_{fi} = 1$ was used to estimate the endurance limit.

The second part of the experimental work focused on the study of crack initiation, propagation and final failure of the vee-notched cylindrical specimens with different notch root radii (or k_t). The results show that a theoretical curve which represents the crack initiation at the notch can be estimated by dividing the endurance limits of a smooth specimen by the elastic stress concentration factor (k_t). It was also revealed that the crack initiation and final failure in air and corrosion coincide at the similar k_{tcrit} value for each type of tested materials.