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LIFETIME OF AIRCRAFT ALLOY PLATES WITH COLD EXPANDED HOLES

P. Yasniy^a, S. Glado^a, V. Iasnii^{a*}^a Ternopil Ivan Pul'uj National Technical University, 46001, 56 Ruska str., Ternopil, Ukraine**Abstract**

The results of study of cold expansion holes and their diameters on stress distribution, fatigue crack nucleation and its growth under uniaxial loading of plates are presented. A series of fatigue tests were carried out using plates containing plain holes and cold expanded holes in aluminium D16chT alloy (Al 2024-T3). In all cases, the increase of plain and cold expanded hole diameter from 8 mm to 10 mm increases crack initiation lifetime with a length of $c_1 = 0.25$ mm and 0.5 mm. With the increase of cold expansion degree, the relative fatigue lifetime of specimens with both diameters decreases for a crack to initiate with the length of 0.25 mm, and increases for the crack to initiate with the length of 0.5 mm.

Keywords: aluminium alloy; cold expansion; mandrel; residual stress; fatigue crack.

Nomenclature**Nomenclature**

c_1	entrance face crack length
c_2	exit face crack length
d_0	diameter of a hole before cold expansion
d_f	diameter of a hole after cold expansion
i	cold expansion degree
A, m	fatigue curve parameters
N_i	fatigue crack initiation lifetime
N_f	total lifetime
R	stress ratio
σ_{\min}	minimum stress
σ_{\max}	maximum stress
σ_{res}	residual stress
σ_y	yield strength
σ_{σ}	tensile strength
$\Delta\sigma$	stress range

1. Introduction

The fatigue of materials and structures acquired special significance due to the rapid development of industries, such as aerospace, automotive and mechanical engineering. Requirements

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