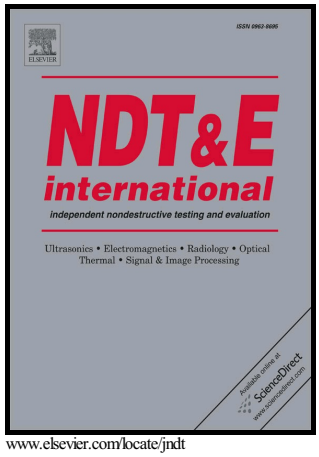

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Evaluation of mechanical performance of NiCo nanocoated aerospace aluminum alloy using quantitative photo-thermo-mechanical radiometry as a non-contact strain gauge

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Abstract

Non-contact photo-thermo-mechanical radiometry (PTMR) was introduced to evaluate the mechanical properties of an aerospace aluminum alloy with Nickel Cobalt (NiCo) coatings. A home-made small-scale tensile rig was used to apply static uniaxial tensile load on the samples. The strength of nanocoated samples was recorded in terms of strain by an adhesive strain gauge also acting as a PTMR calibration device. For the purpose of non-destructive evaluation, the tests were limited within the elastic regime. Two experimental modalities were used: frequency scan at fixed load and strain scan at fixed frequency. The test results were analyzed with both a three-layer and a more detailed five-layer thermo-mechanical-wave (TMW) model. Both theoretical and experimental results indicated that the presence of the NiCo nanocoating can significantly strengthen the mechanical properties of the coated aluminum substrate. The coating can also provide protection to defective substrates and enhance their mechanical stiffness (strength).

Keywords: thermal diffusivity; nickel-cobalt (NiCo); nanocoating; non-contact; non-destructive; photo-thermo-mechanical radiometry (PTMR)

1. Introduction

The mechanical performance of aerospace materials in terms of stability and durability is a very