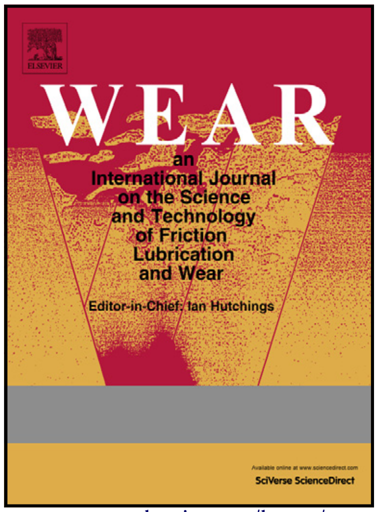
Author's Accepted Manuscript



www.elsevier.com/locate/wear

Surface topography parameters as a correlation factor for liquid droplet erosion test facilities

E.F. Tobin, O. Rohr, D. Raps, W. Willemse, P. Norman, T.M. Young

PII: S0043-1648(15)00163-5
DOI: http://dx.doi.org/10.1016/j.wear.2015.02.054
Reference: WEA101359

To appear in: *Wear*

Received date: 1 July 2014
Revised date: 13 February 2015
Accepted date: 17 February 2015

Cite this article as: E.F. Tobin, O. Rohr, D. Raps, W. Willemse, P. Norman, T.M. Young, Surface topography parameters as a correlation factor for liquid droplet erosion test facilities, *Wear,* http://dx.doi.org/10.1016/j.wear.2015.02.054

Surface topography parameters as a correlation factor for liquid droplet erosion test facilities

E.F. Tobin[1], O. Rohr[2], D. Raps[3], W. Willemse[4], P. Norman[4], T.M. Young[*1]

[1] *University of Limerick, Department of Mechanical and Aeronautical Engineering, Limerick, Ireland*
[2] *Airbus Group Innovations, Metallic Technologies & Surface Engineering, 81663 Munich, Germany*
[3] *Airbus Helicopters, 86609 Donauworth, Germany*
[4] *Saab Commercial Aeronautics, Linköping, Sweden*

Received Date Line (to be inserted by Production) (8 pt)

Abstract

An evaluation of six different coatings was completed in a set of inter-laboratory tests, involving three rain erosion test facilities. Results from two whirling arm type test facilities and one water-jet test facility were compared in the test campaign. The materials and coatings that were investigated included clad aluminium alloy, paint coatings, polyurethane tape, plasma vapour deposited thin film and sol-gel coating. The surface topography of the test coupons was measured using a confocal laser scanning microscope. Using the primary profile of the surface, a comparison was made based on the incubation time or time to failure in the case of coatings. Correlation factors were estimated between the three test facilities. A comparison of the surface features and the surface topographical parameters lead to correlations for two different impact velocities at two of the facilities. Cross correlations between facilities and impact velocities were also shown with this method to within 20 %. The incubation period was the main measure of the resistance of the coatings to rain erosion.

Keywords: Rain erosion; roughness measurement; incubation period; test facilities; inter-laboratory testing.

1 Introduction

Resistance of aircraft leading edges to high velocity water droplet erosion during flight has, once again, become of keen interest to the aeronautics community. The subject was extensively investigated from the early 1950s to the 1970s, with the main focus of the research directed at supersonic military applications [1-4]. Radomes, in particular, were seen to be vulnerable to this form of erosion [2]. At subsonic speeds, structural materials, such as aircraft-grade aluminium, titanium alloys and steels, provided adequate resistance to the repeated effects of water droplet impact, although paints and other surface finishes could still be damaged. The widespread interest in the use of carbon fibre reinforced composites (CFRP) for commercial aircraft primary structures, including wing and empennage leading edges, has brought the topic to the fore once again. A second

[*] Corresponding author. Tel.: +35361202531; fax: +35361202944.
E-mail address: trevor.young@ul.ie (T.M. Young)