

Author's Accepted Manuscript

Experiments on liquid droplet impingement erosion
on a rough surface

N. Fujisawa, S. Takano, K. Fujisawa, T. Yamagata



PII: S0043-1648(17)31190-0
DOI: <https://doi.org/10.1016/j.wear.2017.12.003>
Reference: WEA102310

To appear in: *Wear*

Received date: 29 July 2017
Revised date: 2 December 2017
Accepted date: 2 December 2017

Cite this article as: N. Fujisawa, S. Takano, K. Fujisawa and T. Yamagata, Experiments on liquid droplet impingement erosion on a rough surface, *Wear*, <https://doi.org/10.1016/j.wear.2017.12.003>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Experiments on liquid droplet impingement erosion on a rough surface

N. Fujisawa^a, S. Takano^b, K. Fujisawa^a, T. Yamagata^a

^aFlow Visualization Research Center, Niigata University

^bGraduate School of Science and Technology, Niigata University

Corresponding author: fujisawa@eng.niigata-u.ac.jp (N. Fujisawa)

Abstract

Liquid droplet impingement (LDI) erosion on a rough surface was studied experimentally in the initial stage of erosion using spray-jet impingement on various levels of sandpaper roughness and single groove roughness. The experimental results using an aluminum specimen indicated that the incubation period decreased and the erosion rate increased with increasing the relative roughness, defined as the ratio of roughness height to droplet diameter, in a range of small relative roughness. The growth of the erosion rate in a large relative roughness is almost constant for the sandpaper roughness with increasing the relative roughness, while the erosion rate for the groove roughness decreased at large relative roughness. Therefore, the erosion rate of the groove roughness indicated a peak at small relative roughness. This might be due to the influence of smooth surface surrounding the single groove roughness. A scanning electron microscope (SEM) observation for the small relative roughness of groove showed that erosion was started on the sidewall of the grooves and was followed by the penetration of erosion perpendicular to the groove. The erosion initiation points shifted from the sidewall to the bottom of the groove with increasing the relative roughness, which might be due to the effective impact angle variation across the groove.

Keywords: Liquid droplet erosion; Surface roughness; Erosive mechanism of liquid; Sandpaper; Groove; SEM

1. Introduction

The erosion of metal material due to liquid droplet impingement (LDI) is an important topic of interest in industrial fluid mechanics and material science. Such erosion has been observed in pipelines of nuclear and fossil power plants [1-3], crack initiation on gas-turbine blades [4, 5], and rain erosion of the material of aircrafts, helicopters, and wind-turbines operating under rainy conditions [6, 7].

LDI erosion has been studied experimentally and theoretically with significant focus on single liquid droplet impingement on a solid wall, because this provides the fundamental mechanism of

Download English Version:

<https://daneshyari.com/en/article/7004000>

Download Persian Version:

<https://daneshyari.com/article/7004000>

[Daneshyari.com](https://daneshyari.com)