Study of erosive surface characterization of copper alloys under different test conditions

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ABSTRACT

In this study, the erosive behavior of copper alloy has been assessed practically at different test conditions using dry compressed air jet test rig under surrounding room temperature. Asymmetrical silica sand (SiO\textsubscript{2}) is taken into account as erodent particle within the range of 300-600 µm. The impact velocities of 30–50 m/s, impact angle 15–90° and stand-off distance 15–25 mm are chosen as operating parameters to investigate the variation of data of erosion rate. The highest level of erosion is obtained at impact angle 15° which ensures the ductility behavior of the tested copper alloys. Increased trends of erosion are observed at increased velocity. Mass loss of copper alloy decreases with the increase of stand-off distance. The range of erosion varies from 26.82%-39.83%, 26.12%-40.63%, 36.87%-30.33% and 39.29%-27.86% for erodent size, impact velocity, impact angle and stand-off distance respectively. After erosion process, the damage propagation on surfaces is inspected utilizing Scanning Electron Microscope (SEM) for the affirmation conceivable of nature of the wear behavior. Damage surfaces of copper alloy in some particular cases indicate the detachment of large fragments and plastic deformation with pitting and ploughing action. 3D SEM was used to determine the roughnesses of damage surfaces at different processing and operating conditions. The biological composition of eroded test samples is observed by energy dispersive X-ray analysis (EDX) examination.

1. Introduction

Erosive damages of various materials in current technological systems are extremely concerning issue for supportability of the materials with these unfriendly conditions. In modern mechanical engineering and industrial sector, the light weight of engineering materials has a few applications for minimizing the working and additionally introductory speculation cost. In various ecological conditions, wind turbine, blower fan blade, hydraulic turbine impellers, the moving segments of high speed car, big ship, aircraft, high speed train structure manufacturing by various metals and alloys. The copper alloy can be utilized broadly as a part of erosive wear environment for its simple manufacturing method, suitability to design different systems and mechanisms and lower manufacturing and operating cost.

The several researchers have been investigated by the different tribology research groups \cite{1-10} and observed that erosive wear of materials close related with the different factors such as impact angle, impact velocity, different particle size, different particle shape, particle type, temperature, nozzle geometry, type of materials, hardness of the materials, stand-off distance, test duration, roughness of the investigated materials etc. Among these elements impact velocity and impact angle have been perceived as two parameters that discernibly impact the erosion rates of different materials \cite{6}. The erosive nature of AISI 440C stainless steel and a cermet also directed by researchers \cite{7} observed that both of the materials exhibited at plasticity during impact conditions, but in case of stainless steels which has been described more ductile in nature.

The past works \cite{1-8,11-14} on metal and alloys changing with various and working conditions and in additional mechanical properties and different percentage of material combinations on the erosion of materials cannot suggest any concentrated trends of the results. Therefore, the objective of this work is to research the erosive wear