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REDUCTION OF TOOL WEAR BY USING ALUMINIUM OXIDE NANOPARTICLES WITH EXPERIMENTAL ANALYSIS

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ABSTRACT

Machining is a major manufacturing process, contributes to the majority of the products cost. Economy of machining is affected by the frequent interruptions during tool change as cutting tool wears, thus prolonging the production times and increasing the cost of product. All of the parameters, cutting temperatures and cutting forces are found to affect tool wear the most. Lubricants are substances introduced to reduce friction between two moving surfaces. In order to arrive at a decision on effectiveness of the cutting fluids with Nano particle inclusions, it is necessary to investigate on the properties of the fluids, their machining performance. In the present work, cutting fluids with varying Al2o3 content are formulated and used in machining. Cutting forces, cutting temperatures, surface finish of the samples and tool wear are measured during the machining tests under constant cutting conditions using HSS. In the present work, cooling abilities of the fluid are assessed by the carrying out machining tests using the fluids with and without nanoparticles (aluminum Nanotube) inclusion. Such as 1%, 2%, and 3% nanoparticles. The wear test of the cutting tool conducted on pin on disk machine

INTRODUCTION

Nano materials are cornerstones of Nano science and nanotechnology. Nano structure science and technology is a broad and interdisciplinary area of research and development activity tha has been growing explosively worldwide in the past few years. It has the potential for revolutionizing that can be accessed. It is already having a significant commercial impact, which will assuredly increase in the future.

NANOMATERIALS:

Nano scale materials are defined as a set of substances where at least one dimension is less than approximately 100 nanometers. A nanometer is one millionth of a millimeter - approximately 1,00,000 times smaller than the diameter of a human hair. nanomaterial are of interest because at this scale unique optical, magnetic, electrical and other properties emerge. These emergent properties have the potential for great impacts in electronics, medicine and other fields

HISTORY OF NANOMATERIALS

The history of Nanomaterial's began immediately after the big bang when nanostructures were formed in the early meteorites. Nature later evolved many other nanostructures like seashells, skeletons etc. Nano scale smoke particles were formed during the use of fire by early humans. The scientific story of Nanomaterial's however began much later. One of the first scientific report is the colloidal gold particles synthesized by Michael faraday as early as 1857. Nanostructure catalyst have also been investigated for over 70 years. By the early 1940's, precipitated and fumed silica nanoparticles were being manufactured and sold in USA and Germany as substitutes for ultrafine carbon black for rubber reinforcement.

METHODOLOGY

This test was conducted on a scanning electron microscope at specified test duration .sample and wear tested materials are taken. First work piece is fixed on the machine at one stage. Then closed door. The high vacuum is created on the material .the material wear areas are showed on image. The results are displayed by computer.

EXPERIMENTAL DETAILS

TEST MATERIAL DETAILS

Test material is called as simply as pin the properties and different views given below.

Stainless Steel –Grade 410

Material specification

Diameter = 6mm

Length = 20mm

Volume = 120m3

Chemical formula:

Fe, , <0.15%C,

11.0-13.5%Cr,

<1.0%Mn

<1.0%Si,

<0.04%P,

>0.03%S

PHYSICAL PROPERTIES

Density (kg/m3) - 7750

Elastic modulus (GPa) - 200

Mean coefficient of thermal

Expansion (mm/m/ºc0-100ºC - 9.9

Thermal Conductivity(W/m.K) 100ºC - 24.9

Specific Heat (J/kg.K) 100ºC - 460

PIN ON DISC MACHINE PROCEDURE

The test set up used in this investigation was pin-on-pin wear test apparatus. The test pin 6 mm dia and height 20 mm. The surface of the specimen comes in contact with the mirror finishing surface of hardness 410 SS, the mirror finishing surface used in the present work is an alloy steel pin having dimensions of 6 mm diameter. The test was conducted on a track of 100 mm diameter for a specified test duration, applied load and sliding velocity

Machine model

The JSM-6390 is a high-performance, low cost, scanning electron microscope with a high resolution of 3.0nm. The customizable GUI interface allows the instrument to be intuitively operated, and Smile Shot™ software ensures optimum operation settings. The JSM-6390 specimen chamber can accommodate a specimen of up to 6-inches in diameter

RESULTS AND DISCUSSION

Friction coefficient, frictional force is decreased while the test but Wear increased by with lubricant and nano particles. Whereas different applied load and sliding distance is kept constant at all stages. During second stage applied load is same, but wear is increased and sliding distance is kept constant. The third phase wear is increased and sliding distance is kept constant because the abrasive particles are heated during the operation,

FUTURE WORK

While the lubricants passing the abrasive particles are gets cooled. In future work, the abrasive particles gets harden due to heat and cooled process, so the wear of the sample pin is more compare without lubricant, with lubricant,1% nano particles of with lubricant ,2% nano particles of with lubricant , 3% of nano particles with lubricant and analyses the tool wear using ANSYS software.

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