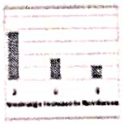



materialstoday: PROCEEDINGS

Volume 54, Part 2, 2022, Pages 441-443

Tribological behaviour of metal matrix composites

D.E. Siddartha [a], Hemaraju [b], Sampath Kumar Patil [a], Siddharth Halundi [a]

[a] Department of Mechanical Engineering, Adichunchangiri Institute of Technology, Chikkamagaluru 577102, Karnataka, India

[b] Department of Mechanical Engineering, BGS Institute of Technology, BG Nagara 571 418, Karnataka, India

Available online 29 October 2021, Version of Record 16 March 2022.

https://doi.org/10.1016/j.matpr.2021.10.175

Abstract

Aluminum 6061 is a precipitation hardening aluminum alloy, has good mechanical properties, and exhibits good weldability. It is used in Aircraft and Aerospace components, Bicycle frames, Drive shafts and Brake components. The addition WC with Ali6061 helps to improve the wear rate of metal matrix composite. In this present investigation, Aluminum (Al 6061) is used as base matrix metal and Tungsten Carbide (WC) particulate as reinforcement. Fabrication of MMCs was done by stir-casting process. Microstructure

Dr. G. M. SATYANARAYANA
B.E.,M. ech.,PhD
Professor and Head
Department of Mechanical Engg.
Adichunchanagiri Institute of Technology,
CHIKKAMAGALURU - 577 102
KARNATAKA - INDIA

Dr. C. T. JAYADEVA
Principal B.E.,M.Tech.,Ph.D.
Adichunchanagiri Institute of Technology
CHIKKAMAGALURU-577102

International Journal of Scientific & Engineering Research Volume 12, Issue 2 February-2021
ISSN 2229-5518

Evaluation and Vibration Analysis of Ball Bearing of Coffee Beans Processing Machinaries using Finite Element Model Simulation

Suresh K. G, Dr. C. T. Jayadeva,

Abstract—Ball and roller bearings, generally called rolling bearings, are among the commonly used components in machineries, since they provide relative positioning and rotational freedom while transmitting a load between two structures, usually a shaft and housing. In various applications, these bearings are considered as critical mechanical component since defect in these components may lead to malfunction, even catastrophic failure. The present work is focused on the development of mathematical models and solution algorithms for the analysis of porous ball bearing in coffee bean processing machinaries. Vibration analysis is one of the most established methods used to evaluate bearings. In this study, finite element model simulation is developed to analyse the vibration of ball bearings and finding initial modes and corresponding natural frequency.

Index Terms— Ball Bearing, Coffee Bean Machinaries, FEM, Natural Frequency, Modal Analysis, 6 Modes, Vibration Analysis.

1 INTRODUCTION

Bearing is a machine element that constrains relative motion and reduces friction between moving parts to only the desired motion. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Many bearings also facilitate the desired motion as much as possible, such as by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts. A bearing being a machine element allows one part to bear (i.e., to support) another. The simplest bearings are bearing surfaces, cut or formed into a part, with varying degrees of control over the form, size, roughness and location of the surface. Other bearings are separate devices installed into a machine or machine part. The most sophisticated bearings for the most demanding applications are very precise devices; their manufacture requires some of the highest standards of current technology. A plain bearing (in railroading sometimes called a solid bearing) is the simplest type of bearing, comprising just a bearing surface and no rolling elements. Therefore the ball (i.e., the part of the shaft in contact with the bearing) slides over the bearing surface. The simplest example of a plain bearing is a shaft rotating in a hole. The present research is carried out on Ball bearings of coffee bean processing machinaries. In the previous experimental work, the vibration is measured using a hand held RIOVIBRO meter. Using a hand held RIOVIBRO vibration meter, overall vibration data has been collected in three directions (vertical, horizontal and axial) of coffee bean processing machinaries for bearing points 1, 2 &3. By using those data's a Finite Element Model Simulation is developed to analyse the vibration of ball bearings and finding intial modes and corresponding natural frequency.

- Suresh K. G. Research Scholar, Department of Mechanical Engineering, Adichunchanagiri Institute of Technology, Chikkamagaluru, Karnataka, India, sureshkg2010@gmail.com
- Dr. C. T. Jayadeva, Principal, Adichunchanagiri Institute of Technology, Chikkamagaluru, Karnataka, India, ctjayadeva@yahoo.co.in

2 .REVIEW OF LITERATURE

The research efforts and direction related to the present work will be identified through the following literature survey.

2.1 N.S.R. Apandi, work presents a numerical approach on the frequency characteristics of new and defected bearings for the increasing rotational frequency of the shaft. The simulated vibrational response of the bearing with different local faults was used to test the suitability of the envelope-analysis technique and the continuous wavelet transformation was used for the bearing fault identification and classification. A 3D model of bearing system with 0.5 mm artificially defects including outer and inner race was modelled by using CATIA software. The numerical simulation was completed by employing ANSYS WORKBENCH 16.0. The simulation result shows the existence of significant and non-synchronous peaks which represent the new and defected bearing defaults with the frequency characteristics of the system.

2.2 J. S. Tripathi, Dr. J. F. Agrawal considering the radial vibrations of rigid shaft supported ball bearings are studied. In the analytical formulation the contacts between the balls and the inner and outer races are considered as nonlinear springs, whose stiffness are obtained by using the Hertzian elastic contact deformation theory.For perfect bearings, vibrations occur at the ball passage frequency. All results are presented in the form of Fast Fourier Transformations (FFT). The experimental validation of a mathematical ball bearing model with localized defects is presented here. The bearing is considered as a mass – spring – damper system, considering each rolling element as a contact spring – damper pair, based on Hertz equations for contact deformation, moving along the inner and outer raceways. In accordance with the obtained results, in this work a bearing model is validated with a purpose built test bench.

2.3 Mr. Shinde S. S, presented the Effectiveness of transient analysis of the finite dement bearing model to simulate the vibration signal emanating from ball bearing with faults is presented in this work. It is difficult to identify the ball bear-

International Journal of Scientific & Engineering Research Volume 12, Issue 2, February-2021
ISSN 2229-5518

DEVELOPMENT AND CHARACTERISATION OF ALUMINIUM ALLOY REINFORCED BORON NITRIDE METAL MATRIX COMPOSITES

Shreenivasaiah P.H.[a], Thammaiah Gowda[a], Kuldeep B.[b], Ravikumar K.P.[c]

[a]Department of Mechanical Engineering, Adichunchanagiri Institute of Technology, Chikmagalur, VTU, India.
[b]Department of Mechanical Engineering, Malnad College of Engineering, Hassan, VTU, India.
[c]Department of Automobile Engineering, Malnad College of Engineering, Hassan, VTU, India.

16

Abstract:

Al2014 alloy reinforced with BN composites were processed by stir casting technique. The developed composite was subjected to micro-structural, Tensile, hardness and density studies. Tensile strength and hardness were increased by 13.3% and 18.7% respectively due to increased dislocation density with the addition of reinforcement. Grain refinement with reinforcement addition was observed. It is found that with increasing reinforcement the strength improves considerably up to certain extent. Thus in the present work an attempt is made to use BN to enhance the property of Al2014

Key Words: BN, Composites, Stir casting.

1.1 Introduction

Aluminum composites are most ideal material owing to their benefits over conventional alloys [1]. In aluminum based composites, strength to weight ratio and toughness character of aluminum are combined with the strength and hardness of ceramics [2]. For development of metal matrix composite stir route are more favored because of its simplicity and cost effectiveness [3]. Owing to poor wettability and porosity stir-casting is popular and low cost method, the problem with wettabality can be overcome by heat treatment of reinforcements prior to addition in melt and also by the accumulation of alloying elements [4].

Many researchers had attempted to improve the behavior of Aluminium by addition of ceramic reinforcements [4]. Baradeshwaran and perumal [5] considered the effect of alumina and graphite on Al7075 composites and concluded that the strength amplified with in corporation of reinforcement. Muthanna et al. [7] stated that, addition of particulate reinforcements acts as obstacles for grain growth which helps to increase the strength of the composites. Kuldeep et al. [6] studied the effect of h-BN on mechanical properties of Al7075 composites and found that with increasing reinforcement the strength improves considerably up to certain extent. Thus in the present work an attempt is made to use BN to enhance the property of Al2014

1. MATERIAL AND METHODS

Al2014 alloy with the chemical composition as shown in Table 1 is chosen as base metal.

Table 1. Chemical Composition of Al2014 in Wt%.

Elements	Zn	Mg	Cu	Cr	Fe	Mn	Ti	Si	Al
wt%	0.2	0.8	4.1	0.1	0.4	1.2	0.2	0.5	Balance

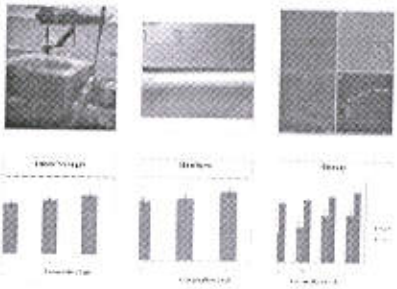
Table 2. Composition of Composites in Wt%.

Sample Code	Composition (wt%)
A	Al2014
B	99% Al2014+2% c-BN
C	98% Al2014+4% c-BN
D	97% Al2014+6% c-BN

Boron nitride (BN) of size >150μm is used as reinforcement having a density of 2.28 g/cm^3,

Outline

Figures (6)



Tables (2)

materialstoday: PROCEEDINGS
Volume 46, Part 17, 2021, Pages 7760-7763

Experimental investigation of cubic boron nitride reinforced Al2014 composites

P.N. Sreenivasan [a], Thammaiah Gowda [b], N. Suldeep [c], A.S.R. Ram [d], K.P. Ravikumar [e], K.P. Mutthanna [e]

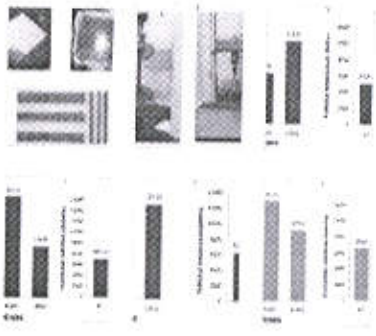
[a] Department of Mechanical Engineering, Adichunchanagiri Institute of Technology, Chikmagalur, VTU, India
[b] Department of Mechanical Engineering, Rajeev Institute of Technology, Hassan, VTU, India
[c] Department of Automobile Engineering, Malnad College of Engineering, Hassan, VTU, India
[d] Mallappa Center of Research, Hassan 573201, India
[e] Department of Mechanical Engineering, Coorg Institute of Technology, Ponnampet, VTU, India

Received 26 December 2020, Revised 13 January 2021, Accepted 9 February 2021, Available online 3 March 2021, Version of Record 18 August 2021.

https://doi.org/10.1016/j.matpr.2021.02.227

Abstract

(18)



materialstoday: PROCEEDINGS
Volume 46, Part 18, 2021, Pages 8980-8984

Identification of mechanical characteristics of Boron Carbide filled glass–epoxy composite treated to low temperature

S. Abhijith Vaidya [a] ✉, T. Rangaswamy [b]

[a] Adichunchanagiri Institute of Technology, Chikkamagalur, Karnataka, India

[b] Government Engineering College, Mosale Hosahalli, Hassan, Karnataka, India

Received 3 March 2020, Accepted 18 May 2021, Available online 1 June 2021, Version of Record 8 September 2021.

Abstract

The present work focus on identifying tensile & flexural characteristics of Boron Carbide (B_4C) filled E-Glass/Epoxy composite with and without

materialstoday: PROCEEDINGS
Volume 47, Part 11, 2021, Pages 3242-3246

Progressive damage characterization of biaxial carbon fiber Reinforced epoxy composites

S.S. Manu [a], G.M. Satyanarayana [b], C.T. Jayadeva [b]

Show more

https://doi.org/10.1016/j.matpr.2021.06.444

Abstract

The objective of the work was to investigate bi-axial characteristics of composite materials with cruciform geometry in both experimental and numerical techniques. The carbon reinforced fibers with epoxy composites prepared by hand lay-up technique with various stacking sequences such as 0°/90°, 45°/45°, 15°/75° and 30°/60°. The fabricated composites were machined in cruciform shape, having different notches namely circular, square and rhomboidal according to ASTM – D6856 standard by abrasive water jet machining to ensure dimensional accuracy of ± 0.1 mm. The prepared cruciform specimens were tested using a biaxial fixture developed indigenously by taking the specifications of universal testing machine. The Young's modulus, proof stress, ultimate tensile strength and fracture toughness were evaluated for 16 specimens of different fibre orientations and notches using software. The response from the biaxial tensile test showed highest

JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 7, ISSUE 17, 2020

Condition monitoring of ball bearings in coffee beans processing machineries – a case study

Suresh K. G[1], Dr. C. T. Jayadeva[2]

[1]Chikkamagaluru,Karnataka India, Principal, Department of Mechanical Engineering, Adichunchanagiri Institute of Technology, Chikkamagaluru, Karnataka, India.

[2]Research Scholar, Department of Mechanical Engineering, Adichunchanagiri Institute of Technology

[1]sureshkg2010@gmail.com, [2]ctjayadeva@yahoo.co.in

Received: 24 April 2020 Revised and Accepted: 04 July 2020

ABSTRACT—In currently's scenario, the conservation of any machinery is very significant because of the interruption of machinery. The bearing segment is one of the patterns without which not particular rotating machinery work. Products of the bearing segment are of it elevation value which indications to the aspects of bearing vibration & solicitation in more demanding situations. This present work statements Design, Experimentation, Finite element and Vibration analysis. Validation of ball bearing connected to coffee processing machinery rotor system. Detail analysis exhausting the vibration is measured using a handheld RIOVIBRO vibration meter(Model VM-63). FEM methodology is through to find out the potential deformation and finally validate with ANSYS workbench software19.2. Vibration recognized in Huller, Peeler cum Polisher and Grader in rotor structure rig examination . Experimental calculation & validation of ball bearing related to coffee processing machinery, ball bearing modeling exhausting in CATIA software and FEM analysis using ANSYS workbench 19.2.

KEYWORDS: Ball bearing , coffee machineries, fem and riovibro

I. INTRODUCTION

This research work affords an summary of the normally employed condition monitoring, fault analysis methods for rolling component bearings in coffee beans processing machineries and deliberates particular of the pros and cons of these techniques.It is significant to have an actual bearing condition monitoring and fault analysis system in abode so that eventually bearing faults can be distinguished and fittingly diagnosed on period to preclude from deteriorating additional to cause destruction to a machine.

For illustration, primary recognition of initial defect of a ball bearing in coffee processing machinery can prime to a timely repairs/replacement to avoid potentially disastrous significance and human forfeiturecaused by the unanticipated disappointment of precarious components.

Mechanism condition monitoring is appropriate toward regulate the condition of a mechanism through the determined to prediction mechanical apparel and failure. The projected data provides healthiness information about the machine and helps to forecast machinery failure. The monitoring equipment pathways variations in temperature, vibration, and output of machineries in demand to notice an imbalance, corrosion, wear, misalignment, sediment build-up.

The Finite element method is a numerical technique for resolving a differential or integral Equation. It has remained functional to several physical difficulties, where the governing differential equations are obtainable. The technique fundamentally consists of assuming the piecewise continuous purpose for the solution and obtaining the limitations of the functions in a manner that decreases the mistake now the solution. Here have to discovery extreme stresses in both section bearing, FEM approach using authenticate the experimental consequences.

Dr. G. M. SATYANARAYANA
B.E.,M. ech.,PhD
Professor and Head
Department of Mechanical Engg.
Adichunchanagiri Institute of Technology,
CHIKKAMAGALURU - 577 102
KARNATAKA - INDIA

International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)
ISSN (P): 2249–6890; ISSN (E): 2249–8001
Vol. 10, Special Issue, Jun 2020, 218–227

INVESTIGATION OF EFFECT OF TESTING PARAMETERS ON EROSION OF CARBON-EPOXY COMPOSITES

MANUS. S[1] & DR. G. M. SATYANARAYANA[2]

[1]*Scholar, Department of Mechanical Engineering, Adichunchanagiri Institute of Technology, Chikkamagaluru, Karnataka, India*

[2]*Professor & Head, Department of Mechanical Engineering, Adichunchanagiri Institute of Technology, Chikkamagaluru, Karnataka, India*

ABSTRACT

The aim of this paper was to conduct experimental study for three fibers oriented (0/90, 55/-55 and 60/30) carbon /epoxy composites at steady state conditions using an abrasive jet. The erosion rates were computed at different impingement angles (30, 60 and 90°), the influence of the abrasive size (177, 250 and 420 mm), impact distance (120, 180 and 240 mm) and impact velocity (36, 54 and 73 m/s) with a constant feed rate of abrasive for 90 min. The experiment results revealed the erosion rate of 55/-55 carbon fiber orientation epoxy composites, lesser than the other fiber orientation composites irrespective of the conditions. Scanning electron microscopy shows that erosion in the carbon epoxy composites surface due to shearing, ploughing as well as inter-granular micro cutting with the abrasive particles being removed from the surface of composites and damage mechanism is discussed.

KEYWORD: Carbon Fiber Composites, Erosion Rate &Scanning Electron Microscopy

Original Article

1. INTRODUCTION

Carbon fiber / epoxy composites are very commonly used in marine, aerospace, space, automotive and civil structure applications due to their inherent properties such as high specific strength, good corrosion resistance, excellent durability and design flexibility. Generally, marine, automotive and civil structures are severely exposed to abrasive erosion, which depends on particle hardness, impact angle, temperature, and particle size [1] for determining of various mechanisms of erosion based brittle and ductility. Researchers conducted various experiments to determine the erosion rate at different flow passages and velocity of sand particles[2-6]. Mcl.aury et.al., investigated the effect of penetration rate, flow velocity, sand rate size on erosion rate of polymer composites. He also established a relation between rate of erosion and other physical characteristics of the abrasive sand particles such as velocity and angle of impact involved. The erosion rate depends on brittle or ductile modes, former one removes the materials due to crack formation on material is impacted by a hard and sharp abrasive particles, but second one removes due to cutting, ploughing and plastically deformed under high compressive and shear stress.

Carbon Fiber Reinforced Plastics (CFRPs) are poor erosion resistant materials, hence, determining the composite performance before using any particular applications is required[7]. The fiber content and fiber orientation are main influencing parameters for specific loading conditions. The brittle fiber, such as untreated glass fiber in the polymer matrix leads to lower erosion resistance. On the other hand, the graphite fiber reinforced polymer composites showed higher erosion resistance against abrasive particles. Ameli et.al.[8] reported that the solid particle erosion rate in carbon fiber reinforced epoxy composites depends on stacking sequence, the existence

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No Access • Published Online: 11 January 2019

Effect of addition of silicon carbide with E-glass/Epoxy composites in mechanical properties subjected to subzero temperature

86

AIP Conference Proceedings 2057, 020026 (2019); https://doi.org/10.1063/1.5085597

S. Abhijith Vaidya[1,a] and T. Rangaswamy[2,b]

Hide Affiliations View Contributors

[1]Assistant Professor, Mechanical Engineering Department, Adichunchanagiri Institute of Technology, Chikkamagaluru, India
[2]Professor and Head, Department of Mechanical Engineering, Government Engineering College, Hassan, India

[a]abhilvaidya@gmail.com

[b]ranga.hassan@gmail.com

ABSTRACT

The current work is an attempt to evaluate mechanical behavior of E-glass/ Epoxy composite materials combined with ceramic fillers at subzero temperature. E-glass/Epoxy composite is selected based on its engineering benefits and ease of manufacturing techniques. This paper focuses on addition of suitable filler material like Silicon carbide for E-glass/Epoxy composite. Later on the fabricated composite materials are treated in Subzero temperature say -100°C. These will portrait the behavior of said composites with the addition of filler materials under Subzero temperature.

Dr. G. M. SATYANARAYANA
B.E.,M. ech.,PhD.
Professor and Head
Department of Mechanical Engg.
Adichunchanagiri Institute of Technology,
CHIKKAMAGALURU - 577 102
KARNATAKA - INDIA

Dr. C. T. JAYADEVA
Principal B.E.,M.Tech.,Ph.D.
Adichunchanagiri Institute of Technology
CHIKKAMAGALURU-577102