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Analysis of salinity from seawater on physical and mechanical properties of laminated bamboo fiber composites with an epoxy resin matrix for ship skin materials

Manik, Parlindungan ; Suprihanto, Agus ; Sulardjaka ; Nugroho, Sri
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[a] Department of Mechanical Engineering, University of Diponegoro, Semarang, 50275, Indonesia

Abstract

The use of bamboo fiber as a natural composite material has been widely studied. The results of previous research indicate that Apus bamboo fiber is highly recommended as an alternative material to replace wood as ship's skin. This study examines the effect of seawater salinity on changes in the physical and mechanical properties of laminated bamboo composites, considering that ships are generally operated at sea. Apus bamboo fibers (Gigantochloa Apus) used in this study came from the Getasan Salatiga area, Central Java. The variables studied in this study have been variations in the number of layers totaling 3, 5, and 7 layers and blade thickness of 1 mm, 1.5 mm, and 2 mm, with the direction of the fibers crossing each other at an angle of 0^o /90^o, and the average width of the bamboo slats has been 20 mm. Apus bamboo fibers are formed into boards reinforced with an epoxy resin with the hand lay-up lamination technique and are given a compressing pressure of 2 MPa, so that a board with a thickness of 6.5 mm with a fiber weight fraction 0.65%–0.75% is formed. The boards have been immersed in the sea for a period of 3, 6, 9, and 12 weeks. In order to determine the effect of seawater salinity on the physical and the mechanical properties of laminated bamboo, the specimen has been characterized by mechanical tests that include moisture content, specific gravity, shrinkage, tensile test, bending test, and impact test. The test results indicate that as the duration of immersion in seawater increases, there will be a decrease in tensile stress by 1.46%-2.61%, in the modulus of tensile elasticity by 1.14%-3.67%, in bending stress by 1.02%–2.28%, in the modulus of bending elasticity by 1.36%-3.45%, and in impact strength by 7.63%-11.51%. The test results on the physical properties of the test object have occurred based on an increase in water content, specific gravity, and changes in thickness dimensions on the test object.

Author keywords

Bamboo Fiber; Composite; Epoxy Resin; Gigantochloa Apus; Laminate; Mechanical Properties; Physical Properties; Salinity

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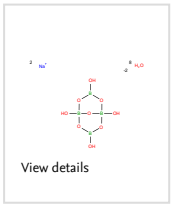
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Effect of Carbon Nanotube on Microstructure and Hardness of Sn96.5Ag3.0Cu0.5 Solder for Microelectronic Packaging

Intan Fatihah[1], Ghazali Omar[2*], Husna A. Hamid[3], Mohd Azli Salim[4]

[*] *Corresponding author*

Authors' affiliations

[1] Universiti Teknikal Malaysia Melaka, Malaysia
[2] Universiti Teknikal Malaysia Melaka, Malaysia
[3] Universiti Teknikal Malaysia Melaka, Malaysia
[4] Universiti Teknikal Malaysia Melaka, Malaysia

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Abstract

This study investigated the SAC305 solder alloy's performance after being reinforced with 0.01, 0.02, 0.03, and 0.04 wt.% of CNT. The performance of reinforced solders was evaluated based on their microstructure and hardness. The reinforced solder's microstructure was observed using Scanning Electron Microscope (SEM) equipped with Energy Dispersive X-ray (EDX). The indentation of reinforced solder was carried out to identify its mechanical properties. According to the P-h graph, the reinforced solder becomes harder as the wt.% of CNT incorporated into the solder increases. The CNT particles were observed to be distributed along the grain boundary and suppressed the solder's crystal nucleation through the pinning effect process. Compared to SAC 305 solder alloy, the reinforced solder has better performance in terms of mechanical properties.

Keywords

Composite Solder; Carbon Nanotube; Hardness; IMC; Nanoindenter

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Prototyping and Study of Jet Systems for Developing Mesh Turbomachines

Yuri A. Sazonov[(1)], Mikhail A. Mokhov[(2*)], Inna V. Gryaznova[(3)], Victoria V. Voronova[(4)], Vladimir V. Mulenko[(5)], Khoren A. Tumanyan[(6)], Mikhail A. Frankov[(7)], Nikolay N. Balaka[(8)]

[(*)] *Corresponding author*

Authors' affiliations

[(1)] National University of Oil and Gas "Gubkin University", Russian Federation
[(2)] National University of Oil and Gas "Gubkin University", Russian Federation
[(3)] National University of Oil and Gas "Gubkin University", Russian Federation
[(4)] National University of Oil and Gas "Gubkin University", Russian Federation
[(5)] National University of Oil and Gas "Gubkin University", Russian Federation
[(6)] National University of Oil and Gas "Gubkin University", Russian Federation
[(7)] National University of Oil and Gas "Gubkin University", Russian Federation
[(8)] CJSC "Russian Company for Shelf Development", Russian Federation

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Abstract

This paper presents a research aimed at developing energy-efficient turbomachines for complicated operating conditions at high gas temperature, high gas, or gas-liquid flow rate, or in the presence of solid abrasive particles in the flow. In the paper, the authors propose to consider possibilities for developing hybrid turbomachines with both jet device and impeller machine properties. The research has been carried out at the junction of two scientific and technical directions. The first one is associated with the field of mesh turbomachinery, while the second direction is associated with the field of jet control systems that enable to control the velocity vector (thrust vector). The software package FlowSimulation (FloEFD) has been used for computer simulation and computational research. The 3D model has been created using the SolidWorks CAD system. Examples show that using a curved mixing chamber, the ejector allows for an energy conversion process similar to the working process in an impeller machine. During the main working time, the gas jet is directed along a curved pipe that serves as a mixing chamber. The hypothesis about the possibility of creating a torque on the turbomachine shaft due to a pulsed reverse flow in the mixing chamber of the ejector located in the turbine rotor cavity has been tested. Based on the results of the computer simulation, conclusions about the prospects of hybrid turbomachines are drawn. Prototypes (micromodels) of the turbine have been developed by using additive technologies. Pneumatic and hydraulic tests of the micromodels confirmed the operability of the proposed technical solution. One of the development directions may be associated with the Euler turbine modernization. It is concluded that the scientific and technical potential of the Euler turbine has not yet been fully disclosed, and research work in this direction should be continued. Findings are applicable in various industries, including energy economy, robotics, aviation, and water transport.

Keywords

Ejector; Energy Conversion; Gas Dynamics; Hydrodynamics; Turbine

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