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Preparation and Testing of Hybrid Metal Matrix Composite-A Case Study

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Abstract

Aluminum metal matrix composites are light weight, cost competitive and have high performance properties. The present study deals with the preparation of the optimized hybrid metal matrix composite Al356 + 3% graphite + 6% silicon carbide after conducting wear tests. The proposed composite is further subjected to tensile test, compression test, and hardness tests. The findings suggest that the conventional brake disc made of Grey Cast Iron can be replaced by the proposed hybrid metal matrix composite for better performance.

Keywords: Preparation, testing, hybrid metal matrix composite.

Introduction

Surappa and Rohatgi (1981) explained the preparation and properties of aluminum alloy ceramic particle composites. Liu et al. (1992) carried out the friction and wear tests on Al graphite composites and explained the smearing process of graphite during sliding. Kevorkijan et al. (2002) described the machining of brake discs made up of Al matrix ceramic composites. Surappa (2003) discussed the challenges and opportunities of Aluminum matrix composites.

The present study is mainly concerned with the development of a hybrid metal matrix composite for brake disc. Composite components were fabricated by varying the silicon carbide (SiC) as reinforcement from 3% to 9% by weight ratio in steps of 3%. The graphite particles were added as second reinforcement to Aluminium alloy Al356 matrix in order to get hybrid composite. When the fabricated composites with varying SiC were subjected to wear tests, better wear resistance was observed for the

Al356 alloy with 3% graphite and 6% SiC. Hence in the present study the preparation and test results of Al356 + 3% graphite + 6% SiC composite has been discussed.

Preparation of Hybrid metal matrix composite

Melting process of composite: 2.5 kg mixture of Al 356 alloy + graphite was taken in the crucible and placed inside the induction furnace at a temperature of 750^0C. When the metal was melted at a temperature 650-675^0C preheated SiC particles were added to the molten metal. An electrical stirrer was used to stir the entire mixture and during stirring scum powder was added to remove the flux. After removal of flux a degasification agent hexachloroethane was added to remove the gas from molten metal.

Preparation of mold box: Mold box was tightened properly with bolts and nuts and preheated to attain good solidification. The mold box must be placed on sand bed to avoid spilling of molten metal while pouring.

Pouring to mold box: After the molten metal was properly stirred, the stirrer was switched off and removed from the crucible. The crucible was lifted from the furnace and the molten metal was poured to the holes in the mold box.

Solidification: The solidification of the molten metal in the mold box takes place between 1.5 to 2 hours. After that the composite metal was removed from the mold box and the mold box was separated by removing the bolts and nuts. The solid composite metal is now ready for further experiments.

Test results of Hybrid metal matrix composite

Tensile test: Ultimate tensile strength = 353.03N/mm^2, % elongation = 2.45.
Thermal conductivity = 190W/m°K
Hardness test: Brinell Hardness Number = 90.99; Rockwell Hardness Number = 115.

Conclusion

The present study successfully prepared and tested the optimized hybrid metal matrix composite. The findings suggest that the conventional brake disc made of Grey Cast Iron can be replaced by the proposed hybrid metal matrix composite for better performance.

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References

[1] Clyne T.W. and Withers P.J. (1993) “An introduction to metal matrix composites”, Cambridge University Press.
[2] Kevorkijan Varuzan, Vuk Dragojevi, Tomaz Smolar, Davorin Lenarcic (2002) “A brake disc in Al based composite”, 36, 6, 421.
[3] Liu Y., Lim S.C., Ray S., and Rohatgi P.K. (1992) “Friction and wear of Al graphite composite: Smearing process of graphite during sliding” Wear, 159, 201-205.
[4] Surappa M.K. and Rohatgi P.K. (1981) “Preparation and properties of aluminum alloy ceramic particle composites”, Journal of Material Science, 16, 983-993.
[5] Surappa M.K. (2003) “Aluminum matrix composites: challenges and opportunities”, Sadhana, 28, 319-334.