

# Twin-Roll Casting of Particulate Reinforced Aluminum Metal Matrix Composites a study on Mechanical Properties

Suchendra K R<sup>1</sup>, M Sreenivasa Reddy<sup>2</sup>, Raghavendra Prasad<sup>3</sup>

Associate Professor, Department of Mechanical Engineering<sup>1,3</sup>

Professor, Department of Mechanical Engineering<sup>2</sup>

R L Jalappa Institute of Technology, Doddaballapura, Bengaluru, India

**Abstract:** In the current research work, Al6061 reinforced with SiC/Al<sub>2</sub>O<sub>3</sub> particles of various configurations has been processed by adopting the stirred casting technique. Energy dispersive spectrometer tests have authenticated that the processed compounds are made up of Al6061 and SiC/Al<sub>2</sub>O<sub>3</sub> hybrid composites. The composition of SiC/Al<sub>2</sub>O<sub>3</sub> has been used in varied concentration of 0, 2, 4, 6 and 8% by weight and added to Al6061. An optical microscopy study has been carried out to identify the configuration of the composite material. In this study, we have attempted to examine the microstructures and thermal behavior of SiC/Al<sub>2</sub>O<sub>3</sub> -reinforced composites with different weight fractions. The microstructure, thermal conductivity, and coefficient of thermal expansion were also examined after adding SiC/Al<sub>2</sub>O<sub>3</sub> to Al6061. Al6061 reinforced with SiC/Al<sub>2</sub>O<sub>3</sub> particles exhibited better thermal properties than without SiC/Al<sub>2</sub>O<sub>3</sub> reinforcement

**Keywords:** Al6061; SiC/Al<sub>2</sub>O<sub>3</sub>; Mechanical properties

## REFERENCES

- [1]. S.C. Tjong, Z.Y. Ma, *Microstructural and mechanical characteristics of in situ metal matrix composites*, Mat. Sci. Eng. R 29 (3) (2000) 49-113.
- [2]. S.M. Choi, H. Awaji, *Nano composites-a new material design concept*, Sci. Technol. Adv. Mater. 6 (2005) 2-10.
- [3]. Y. Li, Y.H. Zhao, V. Ortalan, W. Liu, Z.H. Zhang, R.G. Vogt, N.D. Browning, E.J. Lavernia, J.M. Schoenung, *Investigation of aluminium-based nanocomposites with ultra-high strength*, Mat. Sci. Eng. A. 527 (2009) 305-316.
- [4]. Sabirov I, Murashkin M Yu and Valiev R Z *Nanostructuredaluminium alloys produced by severe plastic deformation: New horizons in development Materials Science and Engineering A* 560 1-24 2013
- [5]. J. Kumaraswamy, V. Kumar and G. Purushotham, A review on mechanical and wear properties of ASTM a 494 M grade nickel-based alloy metal matrix composites, *Materials Today: Proceedings*, Vol 37, 2021, pp 2027–2032, <https://doi.org/10.1016/j.matpr.2020.07.499>.
- [6]. K. Jayappa, V. Kumar, and G. G. Purushotham, "Effect of reinforcements on mechanical properties of nickel alloy hybrid metal matrix composites processed by sand mold technique," *Applied Science and Engineering Progress*, Vol. 14, no. 1, pp. 44–51, Jan.–Mar. 2021, <http://dx.doi.org/10.14416/j.asep.2020.11.001>
- [7]. J. Kumaraswamy, V. Kumar and G. Purushotham, Thermal analysis of nickel alloy/Al<sub>2</sub>O<sub>3</sub>/TiO<sub>2</sub> hybrid metal matrix composite in automotive engine exhaust valve using FEA method, *Journal of Thermal Engineering*, Vol. 7, No. 3, March, 2021, pp. 415-428. <https://dx.doi.org/10.18186/thermal.882965>.
- [8]. J Kumaraswamy, Vijaya Kumar, G Purushotham, Evaluation of the microstructure and thermal properties of (ASTM A 494 M grade) nickel alloy hybrid metal matrix composites processed by sand mold casting, *International Journal of Ambient Energy*, Vol. 43, pp. 4899–4908. <https://www.tandfonline.com/doi/abs/10.1080/01430750.2021.1927836>.

- [9]. Sandeep Khelge, Vijaya Kumar, Vidyasagar Shetty and Kumaraswamy J, Effect of reinforcement particles on the mechanical and wear properties of aluminium alloy composites: Review, *Materials Today: Proceedings*, Vol. 52, Part 3, pp. 571-576, 2022. <https://doi.org/10.1016/j.matpr.2021.09.525>
- [10]. Sandeep Khelge, Vijaya Kumar and Kumaraswamy J, Optimization of wear properties on aluminum alloy (LM22) hybrid composite, *Materials Today: Proceedings*, Vol. 52, Part 3, pp. 565--570, 2022. <https://doi.org/10.1016/j.matpr.2021.09.518>
- [11]. Vidyasagar Shetty, Shabari Shedthi B and Kumaraswamy J, Predicting the thermodynamic stability of perovskite oxides using multiple machine learning techniques, *Materials Today: Proceedings*, Vol. 52, Part 3, pp. 457-461, 2022. <https://doi.org/10.1016/j.matpr.2021.09.208>
- [12]. Kumaraswamy J, Anil K. C., Vidyasagar Shetty and C Shashishekar. Wear behaviour of the Ni-Cu alloy hybrid composites processed by sand mold casting, *Advances in Materials and Processing Technologies*, Vol. 2, pp. 1-17. <https://doi.org/10.1080/2374068X.2022.2092684>
- [13]. Harish R S, Sreenivasa Reddy M, Kumaraswamy J, Wear characterization of Al7075 Alloy hybrid composites, *Journal of Metallurgical and Materials Engineering*, Vol. 28 (2), pp. 291-303. <https://doi.org/10.30544/821>.
- [14]. K.C. Anil, J. Kumaraswamy, Akash et al., Experimental arrangement for estimation of metal-mold boundary heat flux during gravity chill casting, *Materials Today: Proceedings*, Volume 72, Part 4, 2023, Pages 2013-2020. <https://doi.org/10.1016/j.matpr.2022.07.399>
- [15]. J. Kumaraswamy et al., "Thermal Analysis of Ni-Cu Alloy Nanocomposites Processed by Sand Mold Casting," *Advances in Materials Science and Engineering*, vol. 2022, Article ID 2530707, 11 pages, 2022. <https://doi.org/10.1155/2022/2530707>.
- [16]. R.S. Harish, M. Sreenivasa Reddy and J. Kumaraswamy, Mechanical behaviour of Al7075 alloy Al<sub>2</sub>O<sub>3</sub>/E-Glass hybrid composites for automobile applications, *Materials Today: Proceedings*, Volume 72, Part 4, 2023, Pages 2186-2192. <https://doi.org/10.1016/j.matpr.2022.08.460>
- [17]. J. Kumaraswamy, K.C. Anil and V. Shetty, Development of Ni-Cu based alloy hybrid composites through induction furnace casting, *Materials Today: Proceedings*, Vol. 72, pp. 2268-2274. <https://doi.org/10.1016/j.matpr.2022.09.215>
- [18]. Anil, K.C., Kumaraswamy, J., Reddy, M., Prakash, B., Mechanical Behaviour and Fractured Surface Analysis of Bauxite Residue & Graphite Reinforced Aluminium Hybrid Composites, *Frattura ed IntegritàStrutturale*, 16 (62) (2022) 168-179. DOI: 10.3221/IGF-ESIS.62.12
- [19]. Anil K C, Kumaraswamy J, Mahadeva Reddy, Mamatha K M, Air Jet Erosion studies on Aluminum - Red Mud Composites using Taguchi Design, *EVERGREEN Joint Journal of Novel Carbon Resource Sciences & Green Asia Strategy*, Vol. 10, Issue 01, pp130-138, March 2023. <https://doi.org/10.5109/6781059>
- [20]. Sharan kumar, Akash, Anil K C, Kumaraswamy J, Solid Particle Erosion Performance of Multi-layered Carbide Coatings (WC-SiC-Cr<sub>3</sub>C<sub>2</sub>), *EVERGREEN Joint Journal of Novel Carbon Resource Sciences & Green Asia Strategy*, Vol. 10, Issue 02, pp 813-819, June 2023. <https://doi.org/10.5109/6792833>