Influence of Liquid State Stir Casting Method on Agglomeration of Graphite Reinforced Particles in Aluminum Matrix

A. Vinay Kumar
PG Student, Department of Mechanical Engineering, JNT University, Hyderabad

ABSTRACT

Aluminum metal matrix composites are one of the significant revolutions in the development of advanced materials. Graphite, in the form of particulates, has been considered as a high-strength, low-density material. Graphite is a popular reinforcement for metal matrix composites which can be used as solid lubricant and makes the composite self-lubricating material. Aluminium alloys dispersed with graphite particles are known as potential materials for tribiological applications such as bearings, bushings, pistons, etc. Aluminum graphite particulate metal matrix composites produced by liquid state casting method represent a class of inexpensive tailor-made materials for a variety of automotive components. Defects such as agglomerates, and segregation of graphite particulates play a main role in rushing the fracture process.

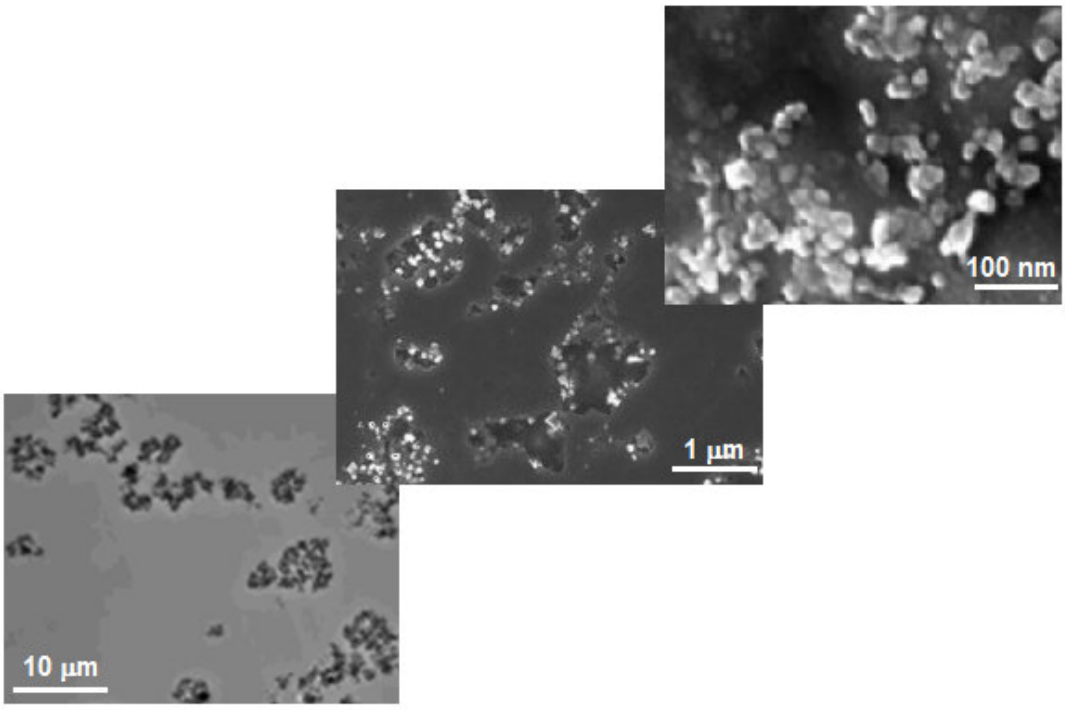

Figure 1: Agglomeration of graphite particles in Al matrix.

The main purpose of this project work was to investigate the influence of liquid state stir casting method on the formation of graphite agglomerates in the aluminum matrix.

The agglomeration of graphite had significantly weakened the composite. After tensile testing, the agglomerated graphite particles were fractured and delaminated. Microstructural characterization was done using a SEM (JEOL JEM-9320FIB). The aluminum matrix phase morphology and the distribution of graphite particulates depend on the relative magnitudes of dendrite arm spacing and inter-particulate spacing. The segregation of particles into the interdendritic regions causes severe agglomeration and interparticle contact, impairing the mechanical properties.

REFERENCES

1. A. C. Reddy, S. Sundararajan, Influences of ageing, inclusions and voids on the ductile fracture mechanism of commercial Al-alloys, Journal of Bulletin of Material Sciences, vol. 28, no. 1, pp. 101-105, 2005.
2. A. C. Reddy, Effect of Porosity Formation during Synthesis of Cast AA4015/Titanium Nitride Particle-Metal Matrix Composites, 5th National Conference on Materials and Manufacturing Processes, Hyderabad, 9-10 June 2006, 139-143.
3. A. C. Reddy, Stir Casting Process on Porosity Development and Micromechanical Properties of AA5050/Titanium Oxide Metal Matrix Composites, 5th National Conference on Materials and Manufacturing Processes, Hyderabad, 9-10 June 2006, 144-148.
4. A. C. Reddy, Effect of TiC Nanoparticles on the Coefficient of Thermal Expansion Behavior of the Aluminum Metal Matrix Composites, 5th National Conference on Materials and Manufacturing Processes, Hyderabad, 9-10 June 2006, 164-168.
5. A. C. Reddy, Tribological Behavior of AA8090/MgO Composites, 5th National Conference on Materials and Manufacturing Processes, Hyderabad, 9-10 June 2006, 169-173.
6. A. C. Reddy, Effect of Clustering Induced Porosity on Micromechanical Properties of AA6061/Titanium Oxide Particulate Metal Matrix Composites, 6th International Conference on Composite Materials and Characterization, Hyderabad, 8-9 June 2007, 149-154, 2007.
7. A. C. Reddy, Mechanical properties and fracture behavior of 6061/SICp Metal Matrix Composites Fabricated by Low Pressure Die Casting Process, Journal of Manufacturing Technology Research, vol. 1, no. 3/4, pp. 273-286, 2009.
8. A. C. Reddy, Essa Zitoun, Matrix Al-alloys for alumina particle reinforced metal matrix composites, Indian Foundry Journal, vol. 55, no. 1, pp. 12-16, 2009.
9. A. C. Reddy, B. Kotiveerachari, Effect of aging condition on structure and the properties of Al-alloy/SiC composite, International Journal of Engineering and Technology, 2, 6, 462-465, 2010.
10. A. C. Reddy, Essa Zitoun, Tensile behavior of 6063/Al2O3 particulate metal matrix composites fabricated by investment casting process, International Journal of Applied Engineering Research, 1, 3, 542-552, 2010.
11. A. C. Reddy, Tensile properties and fracture behavior of 6063/SiCP metal matrix composites fabricated by investment casting process, International Journal of Mechanical Engineering and Materials Sciences, 3, 1, 73-78, 2010.
12. A. C. Reddy, Evaluation of mechanical behavior of Al-alloy/SiC metal matrix composites with respect to their constituents using Taguchi techniques, i-manager's Journal of Mechanical Engineering, 1, 2, 31-41, 2011.
13. A. C. Reddy, Influence of strain rate and temperature on superplastic behavior of sinter forged Al6061/SiC metal matrix composites, International Journal of Engineering Research & Technology, 4, 2, 189-198, 2011.

14. A. C. Reddy, Tensile fracture behavior of 7072/SiCp metal matrix composites fabricated by gravity die casting process, Materials Technology: Advanced Performance Materials, 26, 5, 257-262, 2011.
15. A. C. Reddy, Evaluation of mechanical behavior of Al-alloy/Al2O3 metal matrix composites with respect to their constituents using Taguchi, International Journal of Emerging Technologies and Applications in Engineering Technology and Sciences, 4, 2, 26-30, 2011.
16. A. C. Reddy, Essa Zitoun, Tensile properties and fracture behavior of 6061/Al2O3 metal matrix composites fabricated by low pressure die casting process, International Journal of Materials Sciences, 6, 2, 147-157, 2011.
17. A. C. Reddy, Strengthening mechanisms and fracture behavior of 7072Al/Al2O3 metal matrix composites, International Journal of Engineering Science and Technology, 3, 7, 6090-6100, 2011.
18. A. C. Reddy, B. Kotiveerachari, Influence of microstructural changes caused by ageing on wear behaviour of Al6061/SiC composites, Journal of Metallurgy & Materials Science, 53, 1, 31-39, 2011.