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Effect of Alloying Elements on Particle Incorporation of Boron Carbide Reinforced Aluminum Matrix Composites

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Abstract : The outstanding performance of aluminum matrix composites (AMCs) regarding stiffness/weight ratio makes AMCs attractive material for lightweight construction. Low-density boride compounds promise simultaneously an increase in stiffness and decrease in composite density. This is why boron carbide is chosen for composite manufacturing. The composites are fabricated with the stir casting process. To avoid gas entrapment during mixing and ensure nonporous composites, partial vacuum is adapted during particle feeding and stirring. Poor wettability of boron carbide with liquid aluminum hinders particle incorporation, but alloying elements such as magnesium and titanium could improve wettability and thus particle incorporation. Next to alloying elements, adapted stirring parameters and impeller geometries improve particle incorporation and enable homogenous particle distribution and high particle volume fractions of boron carbide. AMCs with up to 15 vol.% of boron carbide particles are produced via melt stirring, resulting in an increase in stiffness and strength.

Keywords : aluminum matrix composites, boron carbide, stiffness, stir casting
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