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Utilizing nano-B4C reinforcement to significantly enhance thermal stability, compressive and tensile strengths of aluminum

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In the present investigation, Al metal matrix composites containing 0, 0.5 and 1.0 vol.% B4C nanoparticles were synthesized through powder metallurgy route using microwave assisted rapid sintering technique followed by hot extrusion. The influence of ceramic reinforcement nanoparticles (B4C) on the physical, microstructural, mechanical and thermal characteristics of the extruded Al–B4C nanocomposites was investigated. The porosity of the composites increased whereas density decreased with increasing B4C content. Electron microscopy analysis reveals the fine and homogeneous distribution of B4C nanoparticles in the Al matrix. Mechanical characterization results revealed that hardness, elastic modulus, compression and tensile strengths increased whereas ductility decreased with an increase in B4C content. Al-1.0vol.% B4C nanocomposite exhibited best hardness (135.56 Hv), Young's modulus (98.63 GPa) and compression/tensile strength (524.67/194.41 MPa) among the materials investigated. Further, coefficient of thermal expansion (CTE) of composites gradually decreased with an increase in B4C content. Fractured composite samples exhibited shear ductile fracture, dimples and shear zones.

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