

Influence of air-atmosphere ball milling and SPS parameters on the microstructure and mechanical-tribological behaviour of Al-based MMCs

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This study investigates the combined effects of high-energy ball milling under air and spark plasma sintering (SPS) parameters (Temperature, pressure) on the microstructure, mechanical, and tribological properties of pure aluminium and aluminium metal matrix composites (MMC-Al) reinforced with 10 wt.% (SiC, TiO₂), consolidated at T = 550°C to 625°C and p = 50 to 100 MPa. Microstructural and phase analyses were performed using laser granulometry, XRD, SEM. Mechanical and wear properties were evaluated by Vickers microhardness, nanoindentation, and tribological tests. Ball milling led to particle refinement, crystallite size reduction, and increased lattice deformation. XRD analysis further confirmed the formation of aluminium oxide phases on the MMC-Al samples after SPS sintering. The MMC-Al showed significantly higher hardness values 239 HV for Al-SiC and 236 HV for Al-TiO₂ compared to pure aluminium (187 HV). Nanoindentation results revealed heterogeneous microstructural, with regions exhibiting markedly different mechanical properties. Under dry sliding conditions, tribological tests demonstrated a 60 % reduction in wear rate for the MMC-Al compared with pure Al, accompanied by a lower coefficient of friction, especially in localized regions exhibiting values as low as 0.25.

Professional Status of the Speaker

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