Synthesis of RZ5/TiB_2 In-situ Magnesium Matrix Composites and Investigation on the Microstructural and Mechanical Properties

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Abstract

Metal matrix composites have gotten attention as advanced materials with outstanding properties like high specific strength, high specific stiffness, and wear resistance. Nowadays, conventional materials in different automobile and aerospace industries are gradually getting replaced with different composites materials. Magnesium is the lightest matrix material compared to other alloys like aluminum alloy and steel. In the present research study, a self-propagating high-temperature synthesis route is adopted for the in-situ synthesis of RZ5/(4, 6, and 8 wt.%) TiB_2 reinforced magnesium alloy-based metal matrix composites. The RZ5 alloy and cast composites are solutionized to enhance the mechanical properties of the materials. A microstructural study of the composites is carried out using an optical microscope and field emission scanning electron microscope (FESEM) and revealed near-uniform distribution of TiB_2 reinforcement in the magnesium RZ5 alloy matrix. X-ray diffraction showed the formation of the TiB_2 reinforcement along with the transient phase like TiB and MgB_7. The addition of TiB_2 reinforcement in the RZ5 alloy matrix enhanced the hardness, tensile strength, and impact strength of the composites. However, solutionized heat treatment minutely decreased the hardness and impact strength. The ultimate tensile strength and ductility of the composites are improved by solutionizing heat treatment. The FESEM micrograph of tensile fracture surfaces showed micro dimples and tear ridges, indicating a mixed-mode of fracture.

Recent Publications

1. A. Meher, M.M. Mahapatra, P. Samal, P.R. Vundavilli, Study on effect of TiB_2 reinforcement on the microstructural and mechanical properties of magnesium RZ5 alloy based metal matrix composites, Journal of Magnesium and Alloys 8 (2020) 780–792.
2. A. Meher, M.M. Mahapatra, P. Samal, P.R. Vundavilli, Abrasive Wear Behaviour of TiB_2 Reinforced In-Situ Synthesized Magnesium RZ5 Alloy based Metal Matrix Composites, Metals and Materials International 27(9) (2020) 3652-3665.
3. A. Meher, M.M. Mahapatra, P. Samal, P.R. Vundavilli, Modeling the abrasive wear behavior of in-situ synthesized magnesium RZ5/TiB_2 metal matrix composites, Proceedings of the iMeche, Part E: Journal of Process Mechanical Engineering. (2021) 1-11.
4. P. Samal, P.R. Vundavilli, A. Meher, M.M. Mahapatra, Influence of TiC on dry sliding wear and mechanical properties of in situ synthesized AA5052 metal matrix composites, Journal of Composite Materials 53 (2019) 4323–4336.
5. P. Samal, P.R. Vundavilli, A. Meher, M.M. Mahapatra, Reinforcing effect of multi-walled carbon nanotubes on microstructure and mechanical behavior of AA5052 composites assisted by in-situ TiC particles, Ceramics International (2021).



Biography

Arabinda Meher is working as a Research Associate at the School of Mechanical Sciences, Indian Institute of Technology Bhubaneswar, India. His research interest includes the synthesis of different alloys and composites, powder metallurgy, and manufacturability of materials. His current research work is focused on the Manufacturability of in-situ Magnesium Matrix Composites, which includes microstructural and mechanical characterization, tribological behavior, machinability, and solid-state weldability of materials.

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