

Magnesium Based Materials for 21st Century and Beyond

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Abstract

Magnesium is the lightest metallic element that can be used for structural applications in a wide spectrum of engineering and biomedical sectors. Magnesium is one of the most abundant and non-toxic element available in planet earth and is also an essential element for living organisms including plants and animals for their proper growth and biological functioning. In view of above, magnesium can be seen as an element that can be sustained in applications and correspondingly will lead to evolution of sustainable technology for a reasonable time to come. Accordingly, attempts are being made by researchers worldwide to bring magnesium based materials in mainstream applications. Transportation sector is currently seen as the biggest beneficiary as magnesium based materials can reduce weight of the components by ~33% when it replaces aluminum based materials. This will assist in reduction in fuel consumption and CO₂ emissions thus mitigating global warming. Besides, magnesium based materials also exhibit similar or superior electromagnetic shielding when compared to aluminum based materials thus making it an important candidate in electronics and defense sectors. For biomedical applications, magnesium based materials can be designed to degrade in body in controlled fashion thus eliminating the need of revision surgery and minimizing patient trauma, medical cost, doctor's time and recovery time. In view of these multiple advantages exhibited by magnesium based materials, the present talk will focus on recent attempts to evolve magnesium based materials through alloying and composite technology. The properties that are benefitted greatly using these approaches will be highlighted. With proper development and utilization, magnesium based materials have the true potential to be the metallic materials of 21st century and beyond.

Recent Publications

1. Aluminum and Magnesium Metal Matrix Nanocomposites, Lorella Ceschini, Arne Dahle, Manoj Gupta, Anders Eric Wollmar Jarfors, S. Jayalakshmi, Alessandro Morri, Fabio Rotundo, Stefania Toschi, R. Arvind Singh, Springer, Oct. 2016. ISBN: 978-981-10-2680-5 (Print) 978-981-10-2681-2 (Online)
2. Mojtaba Salehi, Manoj Gupta, Saeed Maleksaeedi, Nai Mui Ling Sharon Inkjet Based 3D Additive Manufacturing of Metals, MRF- USA, 2018. ISBN 13: 978-1-945291-45-6
3. G. Parande, V. Manakari, G.K. Meenashisundaram, M. Gupta, Enhancing the hardness/compression/damping response of magnesium by reinforcing with biocompatible silica nanoparticulates, Int. J. Mat. Res., 107 (2016) 1091-1099.
4. Vyasraj Manakari, Gururaj Parande, Mrityunjay Doddamani, Manoj Gupta, Enhancing the ignition, hardness and compressive response of magnesium by reinforcing it with hollow glass microballoons, Materials 2017, 10, 997; doi:10.3390/ma10090997
5. Rachit Pandey and Manoj Gupta, Electromagnetic Shielding Capability of Magnesium Based Materials: A Review, Advanced Materials Letters, 07-09-2017.
6. Manoj Gupta, 3D Printing of Metals, Metals, Sept 2017, Metals 2017, 7, 403; doi:10.3390/met7100403.
7. M. Gupta and KS Tun, An Insight into the Development of Light Weight High Entropy Alloys, Research and Development in Materials Science, 2(2). RDMS.000534, 2017.



Biography

Dr Manoj Gupta was a former Head of Materials Division of the Mechanical Engineering Department and Director designate of Materials Science and Engineering Initiative at NUS, Singapore. He did his Ph.D. from University of California, Irvine, USA (1992), and postdoctoral research at University of Alberta, Canada (1992). In August 2017 he was highlighted among Top 1% Scientist of the World Position by The Universal Scientific Education and Research Network. To his credit are: (i) Disintegrated Melt Deposition technique and (ii) Hybrid Microwave Sintering technique, an energy efficient solid-state processing method to synthesize alloys/micro/nano-composites. He has published over 455 peer reviewed journal papers and owns two US patents. His current h-index is 56, RG index is 46 and citations are greater than 12500. He has also co-authored six books, published by John Wiley, Springer and MRF - USA. A multiple teaching and research award winner, he actively collaborate/visit Japan, France, Saudi Arabia, Qatar, China, USA and India.

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