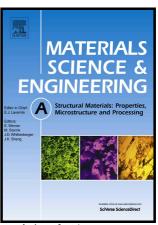
Author's Accepted Manuscript

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www.elsevier.com/locate/msea

PII: S0921-5093(17)31500-9

DOI: https://doi.org/10.1016/j.msea.2017.11.040

Reference: MSA35755

To appear in: Materials Science & Engineering A

Received date: 8 July 2017 Revised date: 12 October 2017 Accepted date: 11 November 2017

Cite this article as: Xian Du, Wenbo Du, Zhaohui Wang, Ke Liu and Shubo Li, Ultra-high strengthening efficiency of graphene nanoplatelets reinforced magnesium matrix composites, Materials Science & Engineering A, https://doi.org/10.1016/j.msea.2017.11.040

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ACCEPTED MANUSCRIPT

Ultra-high strengthening efficiency of graphene nanoplatelets reinforced

magnesium matrix composites

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Abstract:

Homogeneous magnesium alloy (ZK60) reinforced by low content of graphene

nanoplatelets (GNPs) was fabricated by facile melt stirring and hot extrusion processes

with cost effectiveness. GNPs were pre-dispersed with Mg powder and extruded into

rods used as precursor for melting, which effectively guaranteed the integrity and

dispersion of GNPs. In composites, GNPs closely combined with the magnesium matrix

in nanoscale. Compared with ZK60 alloy, the composite with only 0.05 wt.% GNPs can

perform 62% enhancement in yield strength up to 256 MPa, exhibiting an ultra-high

strengthening efficiency of 1550. Based on theoretical analysis, load transfer of GNPs

contributed most (~72%) to the strength improvement of GNP/ZK60 composite, due to

the 2D interfacial contacting and continuous combination of GNPs with matrix. This

study explored the strengthening potential and mechanism of GNPs in metal matrix

composites with insight of scale-up fabrication.

Key words: Graphene nanoplatelets; Magnesium matrix composites; Mechanical

properties; Strengthening efficiency; Strengthening mechanism

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