A Method of Producing High Performance Magnesium Alloy Sheets

IITM Technology Available for Licensing

Problem Statement

- **Magnesium alloy sheet** containing Mg (in hexagonal closed packed (HCP) crystal structure at room temp) & **other alloying elements** is a major engineering challenge, limiting its use to **cast form** and restricting to **lightweight structural materials** of aerospace & automotive sectors.
- It is evident that, by using **Rolling technique** to make **Mg alloy sheets**, one of **ductility or strength** is **compromised** while trying to improve the other.
- Also, this technique involve **multiples processing stages** in manufacturing of magnesium alloy sheet, making process a **complicated, time consuming & costly** process.
- Hence, the present patent is directed to solve the limitations stated above.

Technology Category/ Market

Categories: Advance Material, Chemistry & Chemical Analysis

Industry: Aerospace, Automotive, electronic, Advanced Chemical Materials Manufacturing

Applications: Ductile Mg alloy sheet manufacturing in Sheet Metal Industry particularly interested in light weighting of aerospace and automotive vehicles, Rolling, Sheet development, Light weight metal, Thermo-mechanical processing

Market: The global magnesium alloys market size to be valued at **$6.62B by 2027** and is expected to grow at **9.9% CAGR** during the forecast period.

Technology

The present patent discloses **method (FIG-1)** of producing **high performance magnesium alloy sheets** comprises:

- **preparing a Mg alloy ingot (at least one ZK60, AZ31 and WE43 magnesium (Mg) alloys) with engineered initial microstructure with enhanced microstructural conditions;**
- **heating the Mg alloy ingot in muffle furnace with an inert environment to a predetermined temp (either 250°C or 400°C) ingot for 23-25 minutes;**
- **subjecting the Mg alloy ingot to a hot rolling process with rolling speed of 12 revolution per minute (rpm) with a thickness reduction between 50% & 70% in a single pass;**
- **imparting rolling loads ranging between at least one of 57-63 tons and 45-50 tons during the hot rolling process to produce two grades of high performance Mg alloy sheets.**

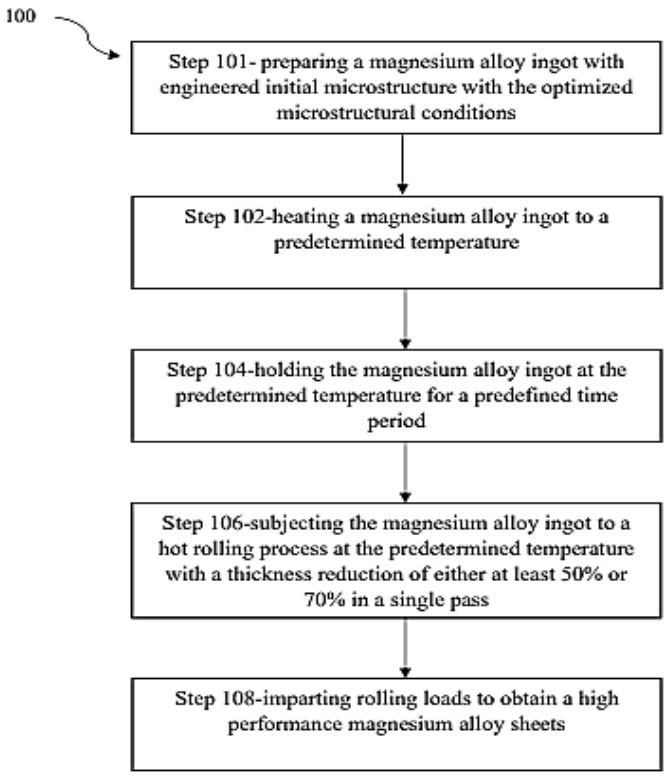

Fig. 1 shows a flow-diagram of method of producing high strength and high ductility magnesium alloy sheet.

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Intellectual Property

IITM IDF No. 2154
Application No. 419749 (Granted)

Research Lab

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Key Features / Value Proposition

- **Increase in ductility & strength.**
- **Less manufacturing stages involved.**
- **High productivity & More economical.**

TRL (Technology Readiness Level)

TRL4:

Technology validated in lab

Images

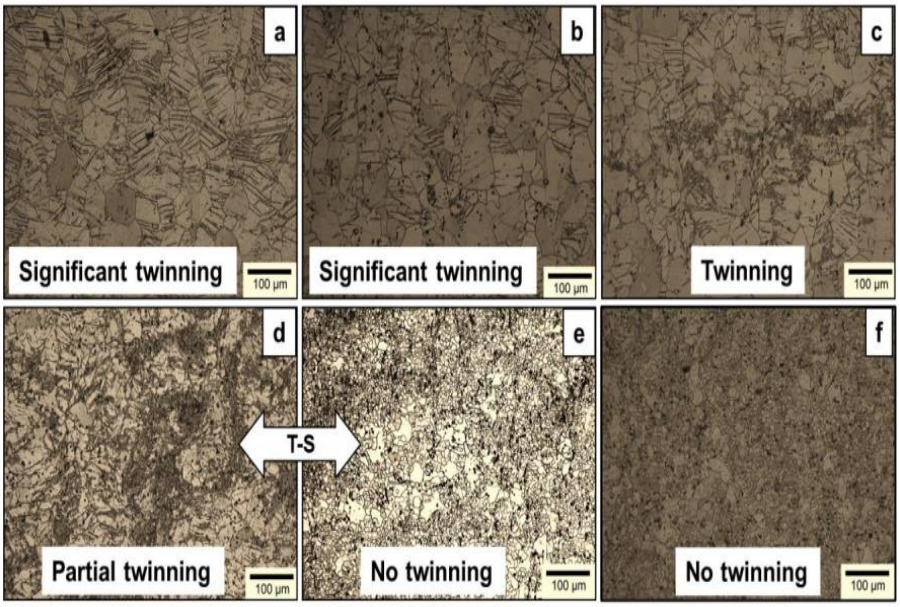

Fig-2 illustrates Microstructures of (a) Base condition, (b) 30% rolled in single pass (c) 40% rolled in single pass (d) 50% rolled in single pass (e) 60% rolled in single pass (f) 70% rolled in single pass. (T-S) Transition from twin mode of deformation to the slip mode of deformation.

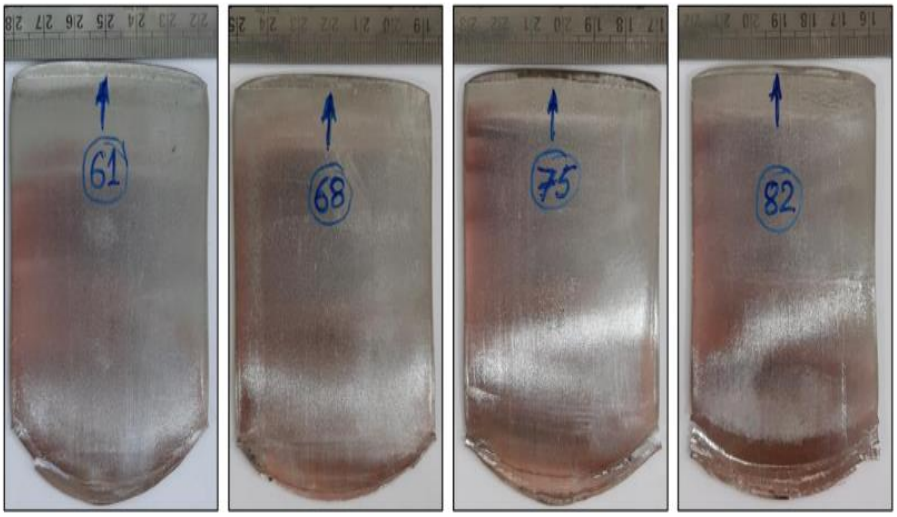

Fig. 3 shows photographic images of rolled sheets of ZK60 magnesium alloy, in accordance with some embodiments of the present disclosure.

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