0147 Metal Hardening for Cast Magnesium

Carbide-dispersion technology for stronger, stiffer and more wear-resistant magnesium alloys

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THE OPPORTUNITY

Lightweight magnesium alloys can be limited by strength, stiffness, hardness and wear performance. This technology disperses carbide particles within the metal grains to improve properties while retaining practical casting routes.

1 TECHNOLOGY

A porous preform of (Nb,Ti)C particles is infiltrated with molten magnesium, dispersed into a master alloy and cast. The particles are engulfed within magnesium grains rather than segregating at grain boundaries.

2 APPLICATIONS

- Magnesium foundries and master-alloy producers
- Automotive, aerospace and transport castings
- Wear-resistant and high-stiffness components

3 KEY BENEFITS

- Uniform particle dispersion within alloy grains
- Higher hardness, stiffness and tensile strength
- Compatible with practical casting processes

EVIDENCE & DEVELOPMENT STATUS

- Stage: laboratory validation; scale-up to centimetre-scale specimens is the next stated objective.
- Mg + 12.5 vol% particles: 87.0 HV3 hardness and 122.5 GPa elastic modulus, versus 34.5 HV3 and 41.0 GPa for reference Mg.
- Mg + 11 vol% particles: 137.8 MPa yield strength and 165.4 MPa ultimate strength, versus 16.4 MPa and 70.5 MPa for reference Mg.
- AZ31 grain size reported at 198 ± 14 µm with NbC addition, versus 464 ± 97 µm for reference AZ31.

IP & OWNERSHIP

- Patents: US granted: CN, EU and Brazil pending

PARTNERSHIP SOUGHT

- Licensing and joint development
- Foundry-scale process validation
- Application testing with magnesium component manufacturers

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