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Design of new alloys from Al-Ti-Zn-Mg-Cu system by in situ Al3Ti formation

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Abstract : With the adoption of High Pressure Die Casting technologies for the production of automotive bodies by the famous Giga Castings, the technology of processing metal alloys in the semi-solid state (SSM) becomes interesting because it allows for higher product quality, such as lower porosity and shrinkage voids. However, the alloys currently processed are derived from the foundry industry and are based on the Al-Si-(Cu-Mg) system. High-strength alloys, such as those of the Al-Zn-Mg-Cu system, are not usually processed, but the benefits of using this system, which is susceptible to heat treatments, can be associated with the advantages obtained by processing in the semi-solid state, promoting new possibilities for production routes and improving product performance. The current work proposes a new range of alloys to be processed in the semi-solid state through the modification of aluminum alloys of the Al-Zn-Mg-Cu system by the in-situ formation of Al3Ti intermetallic. Such alloys presented the thermodynamic stability required for semi-solid processing, with a sensitivity below 0.03(Celsius degrees * -1), in a wide temperature range. Furthermore, these alloys presented high hardness after aging heat treatment, reaching 190HV. Therefore, they are excellent candidates for the manufacture of parts that require low levels of defects and high mechanical strength.

Keywords : aluminum alloys, semisolid metals processing, intermetallics, heat treatment, titanium aluminide
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