

Direct Transformation, Employing Modified Tixoinjection Process in Aluminum Alloy Al356.1 Chip Briquettes

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Introduction

This work describes a proficient and innovative technique for billets production, by a modified direct thixo-injection transformation process of aluminum alloy Al356.1 chip briquettes. A thixo-injection device was built, coupled into a universal testing machine and an inductive heating system, monitored by a temperature acquisition device. The metallic solids of the globular structure, also known as refolded, are metallic alloys that have the final morphology of their microstructure changed to approximate as much as possible of a spherical geometric shape, completely escaping the traditional dendritic morphology of foundry, very common in non-alloys ferrous metals, especially in those with aluminum as the base metal. Depending on the fabrication technique employed, these refolded materials may additionally undergo a refining process, resulting in microstructures of nanometric magnitudes [1-5].

The processes for obtaining structures from liquids involve their agitation during solidification under conditions such that vigorous shear streams are produced between the layers of liquid and therefore strong friction occurs between the liquid and the solid information.

Semi-solid-state processing is capable of producing complex geometry parts without major changes in conventional manufacturing models [5]. Therefore, in this work, an unprecedented methodology for direct transformation of chips (TDC) in cylindrical billets - with microstructural morphology preferentially globular-obtained from aluminum briquettes of the A356.1 aluminum alloy, followed by physical and morphological characterization.

The chemical compositions of the Al356.1 lingots were obtained and presented in the Table 1.

Table 1: Chemical composition Average of samples (%wt).

| Material | Si | Fe | Cu | Mn | Mg | Zn | Ti | Al |
|----------|------|-------|------|-------|-------|-------|-------|------|
| Al 356.1 | 6.59 | 0.126 | 0.19 | 0.089 | 0.334 | 0.078 | 0.198 | Bal. |

Morphological and Microstructural Analysis

Figure 1 shows the general appearance of the microstructure, for each experimental condition evaluated, where one of the most important points in this work is the morphological and microstructural characterization. A common observation of all experimental conditions is the visible refinement of the structure, regardless of its morphology, as compared to cast structures of the same alloy. In addition, all the analyzed samples presented total transformation of the original microstructure of the chip (severely hardening) to dendritic, rosette or globular. The globularized microstructure seems to maintain a stability pattern, both dimensional and morphological, not undergoing major changes in function of the sampling site (Figure 1).

With the obtained results, it is possible to observe that, for the experimental condition of constituted globular structure (condition 6), there is a discrete variation in the values of area of the primary phase and circularity of the globules corrected by the aspect ratio, as a function of the position of measurement. Similar behavior was observed in another experimental

condition forming a globular structure, suggesting to be a behavior independent of the influence of the factors of sample generation. On the other hand, the samples of condition 2, preferential rosette

format, showed a growing increase in the area of microconstituents of the primary phase (15%), from the base to the top, without major changes in the aspect ratio corrected circularity.

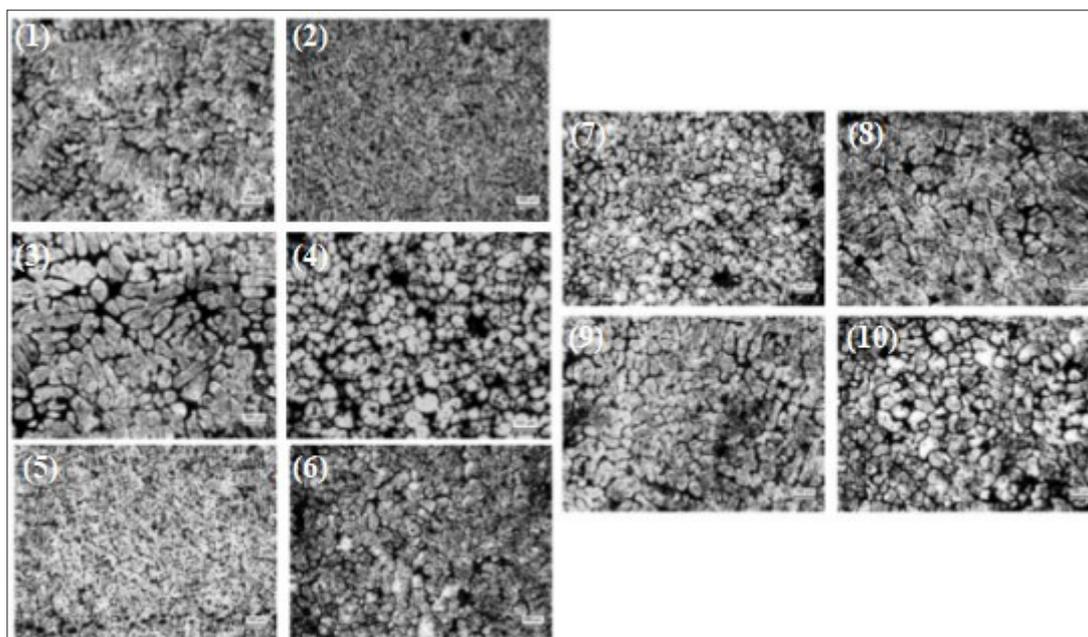


Figure 1: Microstructural morphological aspect for ingot (1) and of the 9 experimental conditions evaluated (2, 3, 4, 5, 6, 7, 8, 9 and 10).

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