
Fig. 1

*We are in the midst of a tremendous shift towards a circular economy, as the aluminium casting industry aims to lower its carbon footprint to meet the standards of the 'net zero carbon emissions' protocols in order to contribute to a sustainable future. Eccomelt LLC, with plants in both the United States and Canada, has a high quality and cost-effective solution: eccomelt356.2, which has one of the lowest carbon footprints of any primary or secondary aluminium alloy on the market today, and is a sustainable, chemically pure and extremely clean replacement for primary AlSi7Mg/A356.2 ingots. It can be used to produce high quality aluminium foundry and structural diecasting alloys, in addition to a silicon master alloy for the production of 6000 series billets and slabs.*

# Eccomelt LLC provides sustainable product to lower your carbon footprint

Founded in 2006, as an offshoot of its parent company, House of Metals Co Ltd, Eccomelt LLC has been innovating since its inception, with its patented, non-thermal method of recycling aluminium wheels by crushing and cleaning them through a proprietary process. CEO Dan Bitton explains: "Our non-thermal technology has garnered eccomelt356.2 the accolade of 'one of the lowest carbon footprints of any aluminium alloy' as calculated by McGill University, the results of which can be viewed on Eccomelt LLC's latest webinar series entitled: *'Facilitating the use of eccomelt356.2 in your furnace'*, intended for purchasing, quality and technical people in foundries and diecasters.

"This innovative non-thermal process, in addition to the product's unique shape, sets eccomelt356.2 apart from other primary or secondary alloys. In furnaces, eccomelt356.2 can significantly increase charge density and therefore melt rate (with minimum melt loss), which reduces energy consumption and increases metal throughput. All of this enables foundries and casthouses to realise energy savings, increase their melt rate, thereby further reducing their carbon footprint while at the same time becoming more competitive and profitable."

Scientific studies back up Eccomelt's anecdotal popularity; the CMQ (Quebec Metallurgical Centre) and others have studied eccomelt356.2 extensively, including a complete analysis of the metal, its surface condition and melting and casting behaviour. The results, published by Martin Hartlieb (Viami International Inc) and Guy Morin (CMQ) in NADCA and AFS papers, confirm what many foundries using eccomelt356.2 in Europe and North America already know: the metal quality and achievable properties of castings made partly or completely from eccomelt356.2 meet and exceed ASTM and typical OEM requirements even for safety critical or structural castings for all casting methods. (See results in table 1).

The extensive studies dispel the typical myths that surround the fact that eccomelt356.2 is in fact recycled post-consumer scrap. The chemical composition is within the EN AlSi7Mg0.3 (42100) specification, and very similar to that of the North American A356.2. The only exception is the Fe content, which is typically in the range of 0.11-0.14 per cent (compared to the 0.12 limit of A356.2).

Moreover, the wheels used in eccomelt356.2 likely contain an even higher purity specification for most elements than shown in table 1, since all wheels used in the automotive industry must fall within a tight specification range and very low impurity content. As a result, eccomelt356.2 is currently being sold to foundries, remelters, refiners and cast houses, mainly as a substitute for primary AlSi7Mg / A356.2, in the form of supersacks of 500kg to 1 ton, suitable for easy handling, logistics and furnace charging. Sample buttons and certified chemical analysis are provided with every shipment. If necessary, eccomelt356.2 can be mixed/diluted with primary aluminium ingots to comply with an even lower Fe target chemistry, or alloyed into other Al-Si foundry/diecasting alloys[1].

In addition, metal cleanliness has been rigorously tested with most common methods including hot PoDFA. All results show that eccomelt356.2 is extremely clean, and can be melted and cast with standard foundry processes, without the need for air filtering (baghouse) or any additional metal cleaning practices. The typical inclusion content for 100 per cent eccomelt356.2 melts are around 0.40mm$^2$/kg. In typical mixes at foundries (of primary ingots, internal returns and 20-40 per cent eccomelt356.2) results between 0.089-0.64mm$^2$/kg were obtained. This compares to reported values of 0.014-0.083mm$^2$/kg with a charge made up of 100 per cent primary ingots, and 0.250-0.843mm$^2$/kg when 100 per cent scrap returns were used[2].

Eccomelt's patented, non-thermal process creates clean metallic surfaces, free of the paint pigments that are typically left on recycled aluminium when alternative delaquering processes are used. Fig.1 tells the story of a product that is extremely clean both internally and externally.

Furthermore, excellent mechanical properties are achievable with eccomelt356.2. Trials with sand and permanent mould castings made with 100 per cent eccomelt356.2 were conducted at an independent

| | Si | Fe | Cu | Mn | Mg | Cr | Ni | Zn | Ti |
|---|---|---|---|---|---|---|---|---|---|
| Max | 7.500 | 0.140 | 0.020 | 0.030 | 0.400 | 0.030 | 0.008 | 0.018 | 0.150 |
| Min | 6.500 | | | | 0.250 | | | | |
| | Ca | Li | Na | P | Pb | Sb | Sn | Sr | AL% |
| Max | 0.005 | 0.0010 | 0.0020 | 0.010 | 0.010 | 0.002 | 0.010 | 0.0200 | Remainder |

Table 1 Chemical Composition of eccomelt356.2

laboratory (CMQ) and the mechanical properties shown in table 2 were obtained.

Some permanent mould castings were HIPped to simulate more advanced high integrity casting processes like low-pressure/ counter-pressure or squeeze casting. All properties exceeded typical minimum requirements by far and clearly demonstrated the high quality and purity of the metal[2].

eccomelt356.2 is currently used in foundries both in North America (Canada, USA and Mexico) and Europe (Eastern and Western), producing a large variety of castings, including safety critical and structural. Typical examples are automotive wheels, suspension components, steering knuckles, cross members, engine cradles, brake components, structural low and high pressure diecastings, etc. It is also used by numerous casthouses to produce high quality foundry alloy ingots as well as an economical, high quality Si master alloy for 6000 series billets and slabs.

Recent studies on the low carbon footprint of eccomelt356.2 as they relate to vehicle lightweighting require further elaboration. With the growth in the production of electric vehicles, the search for a high quality, post-consumer recycled, low carbon footprint aluminium has attained critical importance. Aluminium use in the transportation industry, its largest end-use market, significantly reduces fuel consumption and $CO_2$ emissions through light-weighting components and structures. Vehicle electrification reduces engine hydrocarbon combustion, but adds vehicle weight due to heavy batteries, making light-weighting with aluminium even more important. Although aluminium automotive components increase operation efficiency, their producers are motivated to count and minimise the carbon footprint of their products. One strategy to minimise aluminium carbon footprint is to increase recycling content.

| Condition | T6 T61 Heat Treatment | YS MPa | UTS MPa | E% | Quality index MPa |
|---|---|---|---|---|---|
| *Permanent Mold - Untreated* | *9h at 162 °C* | *226* | *270* | *4.3* | *370* |
| Permanent Mold - Degassed | 9h at 162 °C | 233 | 306 | 8.4 | 446 |
| Permanent Mold - Degassed + HIP | HIP + 9h at 162 °C | 230 | 314 | 12.1 | 477 |
| Permanent Mold - Degassed + Flux | HIP + 9h at 162 °C | 225 | 311 | 9.6 | 459 |
| Permanent Mold - Degassed + Flux + HIP | HIP + 9h at 162 °C | 233 | 317 | 11.5 | 477 |
| *Permanent Mold - Separate Test Bars Min. Value ASTM B108* | *6-12h at 155 °C* | *193* | *262* | *5.0* | *367* |
| Sand Mold - Degassed | 4h at 155 °C | 162 | 258 | 9.6 | 404 |
| *Sand Mold - Separate Test Bars Min. Value ASTM B26* | *2-5h at 155 °C* | *165* | *234* | *3.5* | *316* |

Table 2

The recent study of the carbon footprint of eccomelt356.2, conducted by McGill University, clearly shows that eccomelt356.2 is by far the lowest carbon footprint AlSi7Mg/A356 material in the world due to its low temperature recycling process. An additional advantage to the eccomelt356.2 process is the precision and low variation of its carbon footprint per tonne of A356 estimate – especially compared to any primary aluminium alternative.

Here are the numbers: eccomelt356.2, coming from either of its locations and destined for Europe, has a carbon footprint below 0.2 T CO2e/T of Al with logistics (delivered to Europe). Specifically, the EXW carbon footprint of eccomelt356.2 in Toronto, Canada, is approximately 0.05 and in GA, USA it is approximately 0.15 T CO2e/T of Al (the transportation by ship to Europe adds approximately 0.04 T CO2e/T of Al). Therefore, typical remelted AlSi7Mg ingots (RSI) in Europe have a carbon footprint of at least three times that of eccomelt356.2 if we take the numbers published by European Aluminium (EAA)[4]. Moreover, the carbon footprint of locally produced (European) primary AlSi7Mg ingots is at least 33 times that of eccomelt356.2, and that of the (global) average primary AlSi7Mg ingots is at least 85 times higher than that of eccomelt356.2[4].

As always, Eccomelt LLC is looking towards the future, and plans for new plants are underway. As our circular economy evolves, the need for eccomelt356.2 will increase, and, as evidenced in the efficacy of eccomelt356.2, Eccomelt LLC is ready. *www.eccomelt.com*

## References


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