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ADVANCES IN RECYCLING OF WROUGHT ALUMINIUM ALLOYS FOR ADDED VALUE MAXIMISATION

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Abstract

In recent decades an increasingly large fraction of the world's wrought aluminium alloys supply has come from the aluminium scrap recovered from industrial waste and discarded post-consumer items. The reason for that is the creation of an additional net surplus of the added value commenced from the production of wrought alloys. However, the replacing even a minor part of primary aluminium in wrought alloys with recycled counterpart originated from lower grades of scrap (typically scrap contaminated with various non-metallic impurities) without influencing at the same time the quality of the alloy is very demanding from metallurgical point of view. Developing a more complete understanding of the compositional tolerances in wrought aluminium alloys is still under investigation of many academicals and industrial projects.

Producers of wrought alloys must select the appropriate quantity and quality of scrap to correlate with the chemical composition of the wrought alloy to be fabricated. Hence, extra care must be taken to keep the different aluminium alloys separated. In practice, there are two different approaches for achieving the requested chemical composition of wrought alloys made from recycled aluminium: (i) before melting, by combining the appropriate qualities and quantities of scrap, primary aluminium and the alloying elements and (ii) during melting, by diluting impurity content with primary aluminium to the needed level and adding, at the same time, the necessary amount of alloying elements for achieving their standard concentration in diluted melt. Evidently, the way of achieving of the proper chemical composition of wrought alloys before melting, is more profitable, but also much more demanding from a point of view of scrap pre-screening, optimal pre-sorting and separation. For the typical production (melting performed in the real time) this procedure is also less flexible regarding chemical composition of the available scrap, sorting and scrap allocation due to the overall request for the minimal consumption of primary metal and alloying elements.

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It is important to note that the new added value created by this procedure depending strictly on the successfully replacing of primary aluminium and alloying elements by chipper input composed of different alloy blendes obtained by carefully selection and mixing of various scrap materials. However, the decisions regarding what scrap material to use, which and how much to sort and, finally, allocating material streams to production scrap blendes suitable for the production of wrought alloys across a portfolio of compositions which are to be produced are crucial for achieving the sufficient flexibility and economic benefits.
Key words: Recycling, aluminium alloys, added value

Introduction

In recent years recycling of low grade scrap has become an increasingly important issue of metal supply for both casting and wrought alloys. Looking to the future, production of recycled aluminium of standard quality from the cheapest sources will play an increasingly significant role in the growth of the European aluminium industry. Despite the economic slowdown, the consumption of primary aluminium in the EU is expected to increase to 8 million tons by 2012, while European production of primary aluminium is expected to decrease gradually down to 2.86 million tons by 2012. The gap between the expected production of primary aluminium and its consumption of about 5.24 million tons will be covered by imports and recycling inside the EU. At the same time, the continuous increase in the relative proportion of recycled vs. primary aluminium sources will be driven by the pressure to improve business results and striving for individual profit maximisation. Additional very important benefits of recycling aluminium from low grades scrap are: (i) spreading the risk of a potential shortage of raw materials by diversifying the supply sources of aluminium away from exclusively primary metal and clean scrap suppliers; and (ii) an improvement in logistics - ensuring an appropriate and cost effective supply from different scrap sources. Others advantages of recycling low grades of aluminium scrap are the additional energy savings and higher compositional flexibility in combination with clean grades of scrap and dross.

For several decades, a kind of belief existed in the aluminium industry that the standard quality of wrought alloys could be achieved only by combining a sufficient amount of primary aluminium, internal scrap and only clean, well sorted external scrap. Consequently, ingots made from primary aluminium, internal scrap and clean industrial or external old scrap (single wrought alloy with less than 2 wt. % of non-metallic impurities) were obligatory in the mass production of wrought alloys as the only source of the new and recycled aluminium capable of assuring the standard quality of end products.

Scrap for the production of wrought alloys should be sorted with strict control of the concentration of alloying elements in order to achieve the prescribed compositional tolerances [12]. An additional problem is caused by the very limited ability of wrought alloys to tolerate elements not normally present in their composition. In other words, well defined wrought scrap of the proper composition could be effectively remelted into a wrought alloy of the same composition, but it is very demanding to achieve a new wrought composition by direct reuse, without addition of primary metal and alloying elements. The addition of primary aluminium is necessary to dilute impurities (elements not normally present in wrought alloy) to an acceptable level, while alloying elements are added, if necessary, for correction of their concentration. Thus, most external scrap inside the EU (above 60%) is preferably applied for the production of casting alloys and only the remainder is dedicated to remelting.

Although non-metallic impurities can also significantly influence the quality of the molten metal, it is not obligatory that scrap for wrought alloys should be clean, without organic and other non-metallic impurities, if these could be effectively removed before or during the recycling procedure. Some of the advanced melting furnaces such as various rotary or multi-chamber units enable the direct melting of highly contaminated scrap (e.g. painted and lacquered) with thermal de-coating and recycling occurring consecutively.

Moreover, in internal technical documentation for the production of wrought alloys, more or less empirical compositions were often established, resulting in production mixtures with the prescribed amount of primary aluminium, internal, industrial external and old external scrap. However, it is important to note that such empirical compositions are usually adapted to the common availability of various raw materials and in many cases are below the real potential of possible replacement of primary aluminium by scrap without influencing the standard quality of the final products. The problem is that in many cases these empirical compositions are also approved by the customers, becoming in that way a contractual obligation of the producer of alloys.

On the other hand, it is well known that for aluminium alloys (especially wrought alloys) a practical "compositional tolerance limit" exists and a fairly complete knowledge of these tolerance limits for all elements is needed, especially in recycling operations where unexpected and unusual impurities can creep in inadvertently, and even normal impurities may tend to accumulate and build up to a disastrous degree. In most cases, the influence of these tolerance limits for various elements and various combinations of elements on the properties (and particularly on selected properties) of wrought alloys is not well investigated. Because of that, customers often require more narrow compositional tolerances than are necessary, creating unnecessary losses for themselves and the casting house. Customers lose an important part of the competitiveness of their products in downstream business activities by paying more for non-optimal tolerance limits and, at the same time, the casting house loses the added value by producing alloys from more expensive inputs.

As an example, the average new added value created by producing wrought alloys from external contaminated scrap is about 7% of LME. For aluminium dross in the form of pressed skulls the new added value is significantly higher and could reach approximately one third of LME (considering pressed skulls as internal scrap).

Difficulties in recycling existing wrought aluminium alloys

As already mentioned the main difficulty in production of wrought aluminium alloys from scrap is to achieve the proper chemical composition of the melt with minimal addition of primary aluminium and alloying elements. Technically, the problem is in the missing technology (an economically acceptable chemically based refining process) for reducing the concentration of critical allying elements such as copper, iron, manganese, silicon and zinc, in a melt batch produced from various sorts of scrap. Once the concentration of these critical elements in the melt is above the concentration limit for a particular wrought alloy, the only practical solution would be their dilution by primary metal. Another technical solution is to avoid incorrect melt composition by carefully predicting and assuring the chemical composition of the batch in a pre-melting stage of casting. In principle, there is also a third solution: convince the customers to accept the so-called “recycling friendly wrought alloys” – in other words, alloys with broad compositional tolerance limits and, consequently, to some extent of different quality to cost ratio. This could be an important future trend in developing new wrought alloys, working hand in hand with customers in implementation of their requirements to scrap-friendly compositions [1-4], but for the existing alloys and existing customer demands such an approach has definitely a quite limited potential and is also too risky.

In most of today plants, the predominant mode of recycling – more accurate scrap blending or very strict melt dilution is decided by the margin between recycled metal and primary aluminium. However, it is important to note that this margin-the difference in price of primary aluminium (which is determined globally) and the recycled metal (which is calculated locally)-is affected by internal and external circumstances. Among internal factors the most important are: (i) permanent and stable sources of new and old scrap, concentrated sufficiently in one area to justify the cost of collecting; (ii) a scrap collecting and sorting infrastructure including devices for removing impurities and delivery to a recycling plan; (iii) a method of recycling that is economically competitive with production of primary aluminium and (iv), a market willing to accept the composition and the quality of wrought alloys made from scrap.

More expensive, clean and sorted scrap (mainly new or industrial scrap) contains a minimal concentration of critical elements, while in old scrap of lower cost it becomes more critical. In typical municipal old scrap, which is a cost-effective source of aluminium, the minimal concentration of critical elements (silicon, iron, copper, manganese, zinc, magnesium) is typically too high for direct remelting into wrought compositions without dilution by primary aluminium, Table 1.

On the other hand, in new scrap resulting from the collection and/or treatment of the metal that arises during the production of aluminium products before these are sold to the final users, the right alloy composition is assured in advance; however, the cost of such scrap is significantly higher and its availability is usually limited to closed production loops.

The economics of contaminated wrought aluminium scrap recycling

The economics of wrought aluminium alloys recycling from scrap is specific and differs from the economics of cast alloys recycling since cast alloys have higher compositional tolerance limits for impurities and can absorb a wider variety of scrap. During the production of cast alloys from scrap of various compositions, refiners are able to add alloying elements and remove certain unwanted elements after the melting process. Cast alloys tend to have higher alloy content than wrought alloys and because of that are difficult to recycle into anything other than cast alloys, since the removal of most alloying elements from molten aluminium would be impractical. On the other hand, wrought scrap cannot be used to produce new wrought alloys unless separated by alloys or alloy groups and/or diluted by the addition of primary metal.

Table 1: Typical concentrations of the main alloying elements in old municipal old scrap [13]

Element	Concentration (%)
Fe	0.60-1.00
Si	0.30-9.00
Cu	0.25-4.00
Mn	0.60-1.50
Zn	0.25-3.00
Mg	2.00
Cr	0.05-0.30
Ni	0.04-0.30
Pb	0.02-0.25
Sn	0.02-0.30
Bi	0.02-0.30
Ti	0.05-0.25

In this regard, a possible way of improving the recycling of wrought aluminium alloys is the use of new and old scrap with higher amounts of organic impurities. Most aluminium scrap mixtures currently used for the production of wrought aluminium alloys from low grade scrap have an organic impurities content lower than 8 wt. %. The most common organic impurities are oils, polymers such as polyester and epoxy, rubber, lacquers, paints, etc. In some heavily contaminated aluminium scrap, the organic impurity level exceeds 18-20 wt. %, while in clean industrial scrap the non-aluminium impurity level is usually less than 2 wt.%. The main reasons to start using contaminated instead of clean scrap for production of wrought aluminium alloys are in improved added value (net profit surplus achieved per weight unit of aluminium or aluminium alloys of standard quality recycled from low quality aluminium scrap) and better logistics (scrap sourcing, availability on the market and improved flexibility in supplying). The key advantage is in the fact that the cost of contaminated scrap is significantly lower than the cost of clean scrap of the same presorting quality (e.g. single alloy or single series grade), in that way providing an opportunity for producing aluminium wrought alloys of the standard quality and with improved competitiveness. The prerequisite for that lies in appropriate performance of the entire recycling process, from the scrap sourcing and purchasing strategy to the complete recovery of all by-products, in order to achieve the standard quality of recycled aluminium and the proper economy. In practice, irrespective of the fact that the recycling of contaminated scrap is more demanding and costly than remelting of clean scrap, the total cost per weight unit of recycled aluminium or aluminium alloy of standard quality produced from contaminated scrap is lower than the cost of the remelted aluminium or Al alloy counterpart produced from clean scrap which is nowadays much in demand for the production of wrought alloys.

As a rule, clean scrap (e.g. scrap with a min. of 98 % of Al) represents a costly raw material for the production of wrought alloys. Its market price is close to the theoretically expected, calculated according to the aluminium content and cost of recovery. Therefore, the usage of clean scrap in production of wrought alloys provides only limited possibilities for creating new added value or, in another words, for lowering of the cost of the impute. Typically, the market prices of clean scrap of a single wrought alloy vary slightly below or above the price of the counterpart ingots, depending on their market availability.

On the contrary, the market price of contaminated scrap (scrap with e.g. 80% of Al and 20% non-metallic, mostly organic impurities) ranges significantly (10-25%) below the theoretically expected based on the aluminium content and cost of recovery.

Thus, taking into account the cost of recycling and all related costs, the total cost of production of recycled aluminium alloy fabricated from clean scrap would usually be near the cost of melting the same alloy from primary aluminium (including the cost of the appropriate alloying elements). In contrast to that, by using less clean scrap (scrap contaminated with organic impurities) and applying the proper recycling technology, some higher net added value (typically between 5 and 10%) can be achieved.

It is important to note that the significant part of the new added value is gained by the successful buying of less clean grades of scrap. Hence, it is necessary to understand *the local* new and old scrap market and organize cost-effective buying from the nearest scrap suppliers or though collecting new scrap.

The second part of the new added value is achieved in the process of scrap separation, where an optimal level and method (e.g. hand sorting or automatic screening) of separation should be selected following the compromise between the degree of compositional separation and the cost of achieving it, also taking into consideration that a lower level of compositional separation leads during final melting to the higher consumption of primary aluminium for diluting impurities. Of all the sorting technologies, hand sorting remains the most common method of recovering aluminium. Because a load of mixed scrap (even new, industrial) often includes a limited number of alloys, hand sorting often makes it possible to produce single alloy scrap products. Even if this is not possible, hand sorting can help meet specifications for other scrap grades by removing impurities. Often, a dealer’s experience and knowledge of his suppliers is useful in hand sorting, because the appearance of a piece of new scrap – the shape of a punching, the type of scrapped part – will be sufficient to identify the alloy. Finally, the remaining part of the new added value depends on the competitiveness of the selected remelting technology, which should be able to provide the highest metal yield, a standard quality of the molten metal and operating in accordance with standard environmental regulations.

Melting technologies for contaminated scrap

Generally, regarding the level of organic impurities, two scrap melting approaches are practiced: with or without melting additives [14]. Without melting additives is possible to melt clean scrap, preferably with less than 2-3% of organic impurities and contaminated scrap (with less than about 10% of organic impurities) by applying twin or multichamber melting furnaces. Scrap with a higher amount of organic impurities should be melted with the addition of melting additives (usually a NaCl and KCl salt mixture) in a drum rotary furnace with a fixed axis, which is the universal furnace for melting all kinds of highly contaminated scrap, including aluminium dross and pressed skulls. However, a more advanced and economic way of recycling aluminium from dross and pressed skulls is with a tilting rotary furnace in which recycling can be performed with a significantly lower amount of added salts. In addition, tilting rotary furnaces are often used in recycling cast alloys, while only a limited numbers of such devices have been installed until now for the recycling of wrought alloys. It is important to note that salts provide the best quality of molten metal. The salt mixture covers the aluminium to prevent further oxidation, strips away the oxide layer from the molten metal, promotes coalescence of metallic droplets and dissolves or suspends other impurities attached to the metal. Therefore, the use of salt is imperative for achieving the maximum quality of recycled aluminium, especially when highly contaminated scrap and scrap with a large specific surface area are melted.

However, salts are costly additives in production and result in a significant amount of salt cake by-product, whose processing introduces the extra cost of salt recovery and the deposition of the non-metallic residue on commercial or industrial landfills. The melting strategy for recycling wrought alloys from scrap contaminated with organic impurities depends on several factors, among which the maximal level of organic impurities in the batches prepared for melting is one of the most important. For melting contaminated scrap salt-free, various possibilities exist. The most advanced and integrated device for direct melting of contaminated scrap without melting additives is the multichamber furnace with tower. The alternative is melting contaminated scrap in a twin chamber furnace. However, in this case the organic impurities should be reduced in advance to some acceptable level. Salt-free remelting devices (e.g. three chamber melting furnace, twin-chamber with tower, etc.) are suitable for contaminated scrap having less than 10% of total organic impurities. This could be achieved mechanically, by shredding or by thermal de-coating. The practical alternative is lowering of the amount of organic impurities by mixing the contaminated scrap with a sufficient amount of clean scrap.

In any case, the melting technology chosen will determine the allowed level of organic impurities in the scrap, as well as the eventual necessity for melting additives. Currently, there is no single universal melting device, flexible enough for all grades of scrap (regarding the content of organic and non-metallic impurities, as well as the scrap specific surface area), operating without melting additives. For example, the double pass rotary drum furnace is the only furnace that is suitable for all kinds of scrap. However, it operates with the highest salt factor. On the other hand, salt-free devices are limited by the amount of organic impurities, which also could reduce productivity. The same problem exists in rotary furnaces, where the highest productivity is achieved with a well controlled amount of organic impurities.

Evolution of wrought alloys toward scrap intensive compositions

First of all, it is important to note that customers do not buy a wrought alloy composition but wrought properties. This fact, which is crucial in the negotiation of an *optimal* wrought alloy composition, should be well recognized by both parties involved in an order negotiation - not only by customers, but also by producers of wrought alloys, and vice-versa.

Table 2. Composition and average price of selected scrap types [15, 16]*

Scrap Description	Aluminium content (%)	Oxides (%)	Foreign Material (%)	Average price (% LME)
One single wrought alloy	97.2	1.0	1.8	95-99
Two or more wrought alloys of the same series	97.2	0.8	2.0	80-85
Used beverage cans	94	0.8	5.2	55-60
End of profiles with thermal bridge (one single wrought alloys)	78	3.8	18.2	55-70
Turnings, one single alloy	95.3	3.7	1.0	80-85
Mixed turnings, two or more alloys	84.0	3.3	12.8	75-80
Packaging (coated)	71.5	3.8	24.7	55-65
Packaging (de-coated)	86.1	12.9	1.0	92-95
Dross (one single wrought alloy)	55.7	44.3	-	15-45

*The reported values are only indicative

Unfortunately, in existing, standardized wrought aluminium alloys the tolerance limits for all constituents of the alloys were well defined before scrap recycling become the key issue in added value engineering along the aluminium production chain. Thus, when ordering these traditional alloys, customers are more or less obliged to request a standard composition and properties. The common limitation of the existing wrought alloys is that they are not compositionally tolerant enough to be produced by direct mixing and melting of scrap batches without sorting of the mixed scraps to the desired level. Therefore, traditional wrought aluminium alloys offer only limited opportunities for the direct reuse of recycled wrought alloy scrap without tight compositional corrections (so-called "sweetening") by primary metal and alloying elements.

In current wrought alloys the real operational dilemma of how well to sort [17] depends on the extent of the primary aluminium which is to be substituted by recycled grade without influencing the quality of the wrought alloy. It is absolutely clear that the amount of primary aluminium which could be effectively replaced in a particular wrought alloy by recycled metal depends on the level of compositional separation of the scrap. In other words, more precisely compositionally separated scrap has a higher potential for replacing primary aluminium without affecting the quality of the final alloy. Theoretically, by repurposing the completely sorted scrap (one single wrought alloy), zero consumption of primary aluminium could be achieved in production of wrought alloys. However, in order to avoid the economic inefficiencies occurring when such high value scrap is repurposed into compositionally more tolerant wrought alloys, it is always necessary in practice to measure the net economic benefits of such replacement, taking into consideration the cost of separation and the market value of the selected wrought alloy.

On the other hand, less compositionally separated scrap grades with alloys inside the same series, two wrought alloys of different series or even a mixture of various wrought alloys, will require during melting the additional consumption of primary aluminium for diluting the impurities influencing the final economic benefit of such substitution. In any case, it is important to note that the “de facto” role of the primary aluminium is the dilution of the impurity level (not sufficiently reduced though compositional separation of scrap) and not in providing a sometimes mystic necessary amount of “virgin metal “, which is, according to some opinions, obligatory for achieving the standard quality of wrought alloys.

Finally, again the question of economy arises. By applying a sate-of-the art scrap separation technology, from a technical point of view it is possible to achieve well compositionally separated grades of scrap suitable for direct melting to the appropriate wrought alloys. The problem is that this is still not economically reasonable, due to the high cost of scrap separation to a level of impurities acceptable for the *existing* wrought alloys. For that very reason, the technique of creating new added value through scrap recycling should lead toward the formulation of new, recycling-friendly wrought alloys if, finally, this would be acceptable for the end product customers.

There are several fundamental questions to be answered concerning future developments of new wrought alloys designed to provide wider compositional tolerances of the existing or other alloying elements and hence better opportunities for scrap consumption. The most important one is whether these new alloys could possibly be formulated without critical loss of application properties or, in other words, still provide the valuable and desired combination of wrought properties for customers Significant efforts, scientifically, technologically and financially, will be necessary for achieving this goal and implementing it in industrial usage. Another important question concerns possible long-term reduction in the number of wrought aluminium alloys by establishing a limited number of universal wrought compositions, making refining of alloys easier. Although the unification of wrought compositions was proposed several times in the past, actual development is progressing toward further diversity of alloys and highly tuned properties.

Irrespective of whether a new generation of recycling friendly wrought alloys will be developed or the existing ones unified, it is important to note that newly tailored wrought alloys will require the fulfilment of the following two hardly compatible demands: (i) compositions with relatively broad specification limits on major alloying elements and more tolerant limits on impurities; (ii) without significant restrictions on performance characteristics for final applications. Complete development and implementation of such alloys is, obviously, not an easy metallurgical task and will remain, most probably, the challenge for future decades.

Quality of molten metal

The quality of the molten metal is one of the critical issues, particularly if low grade scrap becomes the dominant raw material for production of wrought alloys of standard quality.

As was already discussed, various scrap melting technologies influence the quality of the resulting metal through the concentration of the most common impurities in the molten aluminium, such as hydrogen, reactive metals and inclusions.

Table 3: Common impurities in primary and recycled molten aluminium [18]

Impurity	Concentration in primary aluminium melt	Concentration in recycled aluminium melt
Hydrogen	0.1 - 0.3 wppm	0.4 - 0.6 wppm
Inclusions (PoDFA scale)	>1 mm^2/kg (Al_4C_3)	0.5 - 5.0 mm^2/kg (Al_2O_3, MgO, $MgAl_2O_4$, Al_4C_3, TiB_2)
Sodium	30-150 ppm	< 10 ppm
Calcium	2-5 ppm	5-40 ppm
Lithium	0-20 ppm	< 1 ppm

Throughout almost the whole of the 20th century, aluminium produced by remelting scrap was treated by customers as less valuable than primary aluminium produced by electrolysis, mostly due to concerns over the purity of the recycled metal compared to that of primary aluminium, Table 3. However, the development of refining technology (in-line degassing and filtration) and analytical methods for measurement of the impurity levels in the past 20 years eliminated this ***stigma*** completely, proving the same quality of ***refined*** molten aluminium, irrespective of its fabrication pre-history.

Challenges for the future

The most important reasons for the increasing demands for lower grade scrap consumption in wrought alloy production are in seeking individual profit maximisation, a shortage of clean scrap and both a shortage and the high price of primary aluminium.

The increased consumption of lower grades of scrap (contaminated external scrap) in production of wrought aluminium alloys makes achieving the standard quality of the end products more challenging. Thus, scrap pre-sorting from alloy to alloy or at least in a series of alloys, proper mixing of various scraps to provide the required chemical composition of the raw material before melting with minimal consumption of ingots and alloying elements, advanced melting technology for achieving a high yield and the required environmental standards, as well as refining and filtration to assure the standard quality of the alloy, are increasingly necessary.

Development of new alloys with the required properties (e.g. tensile properties, workability, deformation etc.) could be achievable with more flexible compositional limits. It would be necessary to develop such recycling-friendly wrought compositions and demonstrate to customers the ability to tailor end properties and the economic benefits created by high contents of scrap.

The following advancements in technology will be necessary to achieve the production of any wrought alloys from scrap without ecological problems:

- Develop and design melting furnaces that minimize melt loss (oxidation and dross formation during remelting) and consumption of melting additives, improve cost effectiveness and productivity, increase safety and reduce emissions,
- Develop a low-cost process for metal purification to enable production of primary alloys from recycled scrap, including methods to remove specific impurities such as Mg, Fe, Pb, Li, Si, and Ti.
- Develop new, scrap-tolerant wrought alloys that better match scrap to specifications for increased utilization.

However, it is important to note that until now, no effective methods exist to fulfil the above requirements technically and economically. Most of these investigations (e.g. metal purification) are still at the stage of fundamental or early applied research, with progress uncertain and not foreseeable. Hence, the earliest eventual implementation at the industrial level might be expected in the coming decades.

Conclusion

Because of high cost and shortages of raw materials (primary aluminium and clean scrap), the main challenge facing producers of wrought aluminium alloys and semis are: (i) is running production with alternative, cost-effective sources of aluminium; and (ii) with sources of metal which are more easily available.

According to the general estimation that between 3-10% of LME is the average amount of new added value achieved by contaminated scrap remelting, consumption of low grade scrap, which is already frequently practiced by producers of cast alloys, is also being increasingly introduced by remelters.

However, in contrast to mixed scrap for refiners, scrap batches for remelting should be compositionally well correlated with the chemical composition of the wrought alloy to be produced (preferably consisting of one alloy) and clean enough (not oxidized or contaminated with non-metallic impurities). Traditionally, remelters were defined as the producers of wrought alloys, mainly from clean and sorted wrought alloy scrap and also distinguished from refiners by a lack of refining capability.

Recent developments in remelting technology and inside the global recycling industry – together with the actual global economic crisis – started to change this traditional framework toward a new mentality of remelters. Following the opportunities for creating new added value in their niche business, remelters reconciled production of wrought alloys from less clean, so-called metallurgically clean scrap, which could be contaminated even with high amounts of various non-metallic (e.g. organic) impurities. In addition, they become familiar with achieving the proper composition of scrap batches before loading the scrap into the furnace (through the refining of scrap), avoiding more expensive dilution of impurities by primary aluminium during melting. To this end, several pre-melting operations (scrap sorting and separation, as well as in house scrap batch compositional blending) were integrated into the production chain, together with some post-melting operations, such as traditional molten metal refining.

With all these changes, contributing essentially to creation of new added value, a new mentality in remelters closer to refining production practice was established inside the EU, increasing the importance of contaminated scrap as a long term source of aluminium for wrought alloys. Actually, remelters well understood that the most significant part of the new added value is created through proper scrap baying and sorting, while only the remainder is gained by advanced remelting. Thus, a kind of "scrap refining" practice must be introduced to keep the different aluminium alloys separated to some appropriate level from the metallurgical and economic point of view. The key issue is to achieve the right alloy composition before melting in the scrap mixture and not at the end of melting by diluting the impurity content to the needed level. The only way to achieve this is by being fully acquainted with scrap quality through an excellent knowledge of the scrap market, the individual scrap suppliers and an internal knowledge of scrap sampling.

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