The direction of development of Magnesium products in Japan

Daisuke Konishi, Advanced Material Japan Corp., Tokyo, Japan

Abstract: The report is consisted with 2 parts. In the first part of it, I will report about updated information about the Magnesium market situation based on the analysis on Import & Export statistics & our own investigation on domestic production data.
In the second part, you can look through current trends for developments categorized by following key words;

1) Projects of Japan Magnesium Association (eg. Automobile, Train etc.)
2) Material Level (eg. Die-casting, Extrusion, rolling etc.)
3) Application (eg. Transportation equipment, Nursing + Medical, Electric machines, Batteries, Acoustic equipment etc.)
4) Recycling
5) Smelting projects

With above several directions of developments, Japanese market is expected to increase its demands for Pure magnesium ingots & Magnesium alloy in coming years.

Introduction:

Our position in the global market; The total consumption for Magnesium metal in Japan is reported as 40,290t in 2013. This is 4-5% of the global market. 88% of its raw material supply depends on China, 7% on domestic recycling industry & the rest 5% is coming from other countries. As for the consumption, the usage for Aluminum alloy additive shares 52%, the products of Magnesium alloy is 17.5%. 13.7% is consumed as Desulfurization flux in the Steel works.

Japan Magnesium Association & its members are recently making efforts to develop new applications with following 3 directions; 1) Developing new Magnesium alloys with property of 'Safety on the process', 'Fire-resistant' & 'Less corrosive' for the final products, Expanding use for the parts of transportation equipment and developing new applications & Inventing brand new items.

Advanced Material Japan Corp. is Tokyo based one of the leading Non-Ferrous metal trading houses. We have over 20years of history on Magnesium business & holding over 10% of share in Japanese market. As a member of Japan Magnesium Association (JMA), we act a window for raw materials imports & exporting Advanced Japanese Magnesium products to International market.

The 1St part - Updated information of Japanese magnesium Market:

Economic fundamentals & back ground; The growth of Japanese general economy after Prime minister Mr.Abe begun new ecomonic policy 'Abenomics' was slow down due to the increase of taxation (Consumption Tax, from 5% to 8% from April, 2014). Real GDP growth has fallen down in the 2Q of 2014 into -7.1% from +6.1% of the 1Q. But this time of recession was rather short. It has already been improved into -1.9% in the 3Q & +1.5% in the 4Q. According to the government, the expectation for the real GDG growth is announced as 2014: -1.0%, 2015: +1.9% & 2016: +1.8%.

The weak currency (Yen), Low petroleum market price & Low market price level on each raw material are supporting Japanese producer's reasonable profits. Also, recent boiling labor costs in Asian countries pushes Japanese producers taking back their plants to their original country. The 'Local production for local consumption' &

expanding the exports of Automobile to the US market supports this movement.

Following companies are reported the production base shifts from abroad;

Company	Plants	From
Panasonic	Electrical Appliances	China
Sharp	Electrical Appliances	China
TDK	Electric Devices	China
Canon	Electric Devices	China Others
Daikin	Air Conditioner	China
Honda	Automobile	The UK
Nissan	Automobile	The US

*Including the producers under consideration.

Growth of Japanese Magnesium Market in 2014; The total consumption for Magnesium in Japan was 40,290t, it is +12.4% in comparison with the previous year. Total import was 39,016t, its 97.62% depended on Chinese supply. As for its major usages, 52% is for Aluminum Alloy additives, 17.5% is for Die-casting parts & other structural materials, 13.7% is for Steel Desulfurization. The increase of demands from Aluminum alloy & Steel desulfurization assisted the total consumption recovered the 40000t mark.Die-casting & Thixo molding that were much expected had slightly decreased its consumption.

The 2nd Part – Current trends for developments in Japan

(Section-1) Projects of JMA: JMA has 2 committees for carrying following two projects forward; 1) Project for Expanding the use for Automobile parts; this main purpose is expanding the Die-cast parts for Automobile. We are willing to develop new kinds of magnesium alloy parts such as modularized Instrument panels & integrated casting Gear box in addition to increasing the number of current 'Staring cores' and 'Seat flames' production. For the purpose to save the production cost into the same level of Aluminum alloy die-casting process, we are developing new Magnesium alloy that molten material don't flame & doesn't need any protecting gas during the process. The target of this project is increasing the consumption for Die-casting parts into 60,000t/year from current 6,000t/year as a goal of the project.

2) High Speed Railway Project; Now, we are willing to expand the use of Magnesium alloy parts for High Speed Railway. The main point is developing Nonflammable Magnesium alloy under high temperature. Currently, a Japanese producer is supplying the joint parts for the overhead baggage rack of 'Shinkansen'. Now, the members of this committee researches producing 25m length of Magnesium alloy plates by extrusion method.

(Section-2) Material Level: KUMADAI alloy that is invented in Kumamoto University has very high nonflammable & high strength property, National Institute of Advanced Industrial Science and Technology (AIST) has developed AZX611, AZX612, AMX602 and AZX912 to be also nonflammable alloy. These new alloys are expected to be used on the parts for Automobile, High Speed railway & Aircrafts.

(Section-3) Application Level; 1) Primary batteries: Furukawa battery began to sell portable Magnesium battery for disaster prevention usage. AQUMO develops small size portable Magnesium battery. Tokyo industrial university is developing magnesium film cassette type metal-air battery for automobile. 2) Music instruments: FOSTEX & TIGLON sell Music cable, Speaker, Speaker stands using magnesium thin foils with high dumping capacity. 4) Welfare Equipment: Tanabe sells light & stylish Sticks, Hamamatsu & Kyushu teams developed stylish & high performance wheel chairs. 5) Construction materials: Gonda metal began to supply 'Expansion Joint' for public buildings such as gymnasium of schools & City halls. This parts are made with AZX611 & AZX612 alloy that has very high tensile strength, high corrosion resist & nonflammable property over 600 degree. AZX alloys accept various kinds of surface treatments & these alloy's structure is rather stable under high temperature & makes limited growth of size of the structure after heat treatments. 'Expansion Joint' has high dumping capacity & absorbs the vibration of big earthquake to prevent the ceiling from corruption. 6) Reflow pallets: the planks

during heat treatment for Semi-conductors.
7) Automobile: Currently, Steering wheels cores and Seat flames are the main products of Magnesium alloy die-casting for Automobile parts. But, as I mentioned in the previous section, our committee is now developing nonflammable molten material alloy & willing to expand Magnesium alloy for this application such as modularized Instrument panels & integrated casting Gear box.
8) Other application: The washing agent material ''Mag-chan'' suggests us bland new way of thinking for Magnesium metal. Miyamoto industry sell small cloth package filled with pure magnesium balls. You just need to put two bags into the washing machine, then you can wash well the clothes without any chemical agent.

(Section-4) Recycling:
The infrastructure for Magnesium alloy recycling has not well equipped, yet. The main factor is the limited production quantity of Die-casting, extrusion and rolling. We have only several numbers of small melting recycling enterprises and have not yet standardized the basic recycling technology & taking the knowledge into common.

As I mentioned in above sections, people are developing new magnesium alloys with special properties as nonflammable, heat resist, corrosion resist, and light weight. But few domestic companies can recycle such new Magnesium alloys. As the result, the most of such scraps is disposed as industrial waste.

Even common grade of alloys such as AZ91D & AM60B are not recycled in house of Die-casting producers in most cases. This makes processing cost of Magnesium alloy parts to be much higher than Aluminum alloys. Also, it hasn't grown up the free market for Magnesium alloy scrap in Japan, yet. This makes most of domestic scrap traders to ship Magnesium scrap mixing in the Aluminum scrap as an impurity.

It is urgent necessity to equip well the Recycling infrastructure in Japan. AMJ is now making most efforts on this field.

(Section-5) Smelting projects:
Smelting projects are expected to be put into practice after beginning stable certain big quantity of supply for Automobile, High Speed trains & Aircraft industry. Tohoku University is studying Pidgeon method that 3 Japanese producers had used for Magnesium production until 1990's. Tokyo Industrial University is studying 'Solar pumped leaser method.

Conclusion:
(Conclusion-1)
1. Magnesium consumption in 2014 was increased in 12.4% from previous year. Mainly, Aluminum alloy additive usage increased the consumption.
2. The economic growth by 'Abenomics' was suspended by the increase of taxation in April/2014. But it has recovered from 3Q.
3. The forecast of Japanese government for real GDP growth is +1.5% in 2015 & +1.8% in 2016.
4. Because of Cheap currency (Yen), Low Petroleum price, Down Stream of raw materials market price & Boiling labor cost in abroad (mainly in China) push Japanese Automobile & Home electronics producer's oversea shifted production bases coming back to Japan.

(Conclusion-2)
1. JMA has 2 committees as 1) Automobile & 2) High Speed Railway for the purpose of developing new Magnesium alloys & support expanding the adoption of Magnesium alloy parts.
2. The Automobile committee is willing to increase the consumption of Magnesium alloy in Die-casting with the target as 10 times of current figure (60,000t).
3. The members of JMA are actively developing the new Magnesium alloys & bland new applications.
4. The infrastructure of recycling is not enough quipped. The keys are 1) In house recycling of Die-casting producers, 2) Recycling new developed alloys & 3) How to treat the fine powder scrap. AMJ is now making most efforts on this field.
5. It would be after reaching certain quantity of consumption from Magnesium alloy in structural materials usage. The domestic Smelting with 1)

Pidgeon method & 2) Solar pumping leaser method is under studying.