The direction of development of Magnesium products in Japan

Japan Magnesium Association
Advanced Material Japan Corp.
D.Konishi
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Japan Magnesium Association
Advanced Material Japan Corp.
Our Position in the global market

- Consumption in 2014: 40,290t (4% of global market)
- Import from: China 97.02%, Russia 0.51%, Other countries 2.47%
- No Domestic smelter
- Usage: Al alloy: 52%, Mg alloy: 17.5%
  Desulfurization: 13.7%
Japan Magnesium Association

115 Regular Members

- Recycle/Smelter: 2
- Material: 8
- Die cast: 17
- Casting (Sand etc): 10
- Wrought: 14
- Fabrication: 7
- Facility: 14
- Surface treatment: 9
- Customers: 17
- Trader: 15
- Organization: 2

12 Supporting Members
75 Private Members

(Data: April, 2015)
Items

1) Magnesium
2) Tungsten
3) Rare Earth
4) Titanium
5) Molybdenum
6) Tantalum, Niobium
7) Antimony, Indium, Gallium, Selenium, Tellurium, Zirconium, Chromium, Manganese, Bismuth, Cadmium …

Advanced Material Japan Corp. 
20 years in Magnesium business
Focusing on Japanese market.

A member of Japan Magnesium Association
Offices locations & Traders

Tokyo Head office

Traders on Mg business

Singapore subsidiary
Advanced Material Trading Pte.Ltd.

Moscow

Vladivostok

Beijing

Shanghai

Hanoi

Tokyo

Moscow

Daisuke Konishi
Yuya Toyama
Nikita Cheprasov
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Economic Fundamentals & background in 2014

- Short recession due to increase of sales tax rate
- Weak currency (Yen) rate & low Petroleum price supports Japanese producers profits.
- Boiling labor cost in Asia pushes production bases back to Japan.

<table>
<thead>
<tr>
<th>Company</th>
<th>Plants</th>
<th>From</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panasonic</td>
<td>Electrical Appliances</td>
<td>China</td>
</tr>
<tr>
<td>Sharp</td>
<td>Electrical Appliances</td>
<td>China</td>
</tr>
<tr>
<td>TDK</td>
<td>Electric Devices</td>
<td>China</td>
</tr>
<tr>
<td>Canon</td>
<td>Electric Devices</td>
<td>China</td>
</tr>
<tr>
<td>Daikin</td>
<td>Air Conditioner</td>
<td>China</td>
</tr>
<tr>
<td>Honda</td>
<td>Automobile</td>
<td>The UK</td>
</tr>
<tr>
<td>Nissan</td>
<td>Automobile</td>
<td>The US</td>
</tr>
</tbody>
</table>

Real GDP growth rate
Growth of Japanese Magnesium Market in 2014

- Total Consumption: 40,290t (+12.4%)
- Total Import: 39,016t, its 97.62% depended on Chinese supply.
- Major usages: Aluminum Alloy additives 52%, Die-casting parts & other structural materials 17.5%, Steel Desulfurization 13.7%.
- 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.
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3-1 Project of JMA

1. Expanding the use for Automobile parts
   ● Expanding the Die-cast parts production
   ● Developing New Mg Die-casting alloy
   ● Target quantity of Die-casting sector is 60000tpy increasing from current 6000tpy

2. High Speed Railway
   ● Developing High strength, Non-Combustible, high productivity Mg alloy wrought materials.
   ● The joint parts for overhead baggage rack has used for High Speed train.
3-2 Material Level

1. New developed Magnesium alloys

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AZX612</td>
<td>High tensile strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High corrosion resistance</td>
</tr>
<tr>
<td>2</td>
<td>AZX912</td>
<td>Non-combustible (up to 600°C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accepts various kinds of surface treatment</td>
</tr>
<tr>
<td>3</td>
<td>AMX602</td>
<td>Less growth of structure size</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Casting, Die-casting, Forging</td>
</tr>
</tbody>
</table>

Product example:
The world’s first magnesium alloy parts for high speed railway (AZX912 by die-cast)
3-2 Material Level

2. Carbon Reinforced Magnesium alloy

- Name: UH magnesium alloy Chip
- Improvement of bending property
- Improvement of mechanical property
- 0.2% proof stress: UH alloy: 180MPa > AZ91D: 150MPa
- Reduced Segregation
- Improvement of anticorrosive performance
- Excellent cast-ability
- Can use normal Thixo-molding process
- Rare-earth free, Low cost
## 3-2 Material Level

### 3. Magnesium alloy extrusion

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Alloys</td>
<td>AZ31, AZ80 &amp; AZX911 etc.</td>
</tr>
<tr>
<td>2.</td>
<td>Mold cast Billets</td>
<td>Φ50mm, φ75mm, φ100mm</td>
</tr>
<tr>
<td>3.</td>
<td>DC Billets</td>
<td>Φ155mm, φ210mm, φ300mm</td>
</tr>
<tr>
<td>4.</td>
<td>Products</td>
<td>Plates: (t)20x200mm, Rods: φ68mm, Square tube: (w)65x(L)50x(t)2.0mm, Round tube: φ88x(t)22mm</td>
</tr>
</tbody>
</table>

**Sankyo Tateyama, Inc.**

- **Sankyo Material-Company**
- **6000t extrusion press**
- **Large & long size extrusion magnesium alloy parts**
  (Target usage: High speed train)
3-2 Material Level
4. heat resist magnesium alloy bolts

AZX912 alloy bolts

Preventing Electric corrosion
Less Thermal Stress
Friendly for most materials
Preventing looseness

Less Seizure & Less Torsion
3-3 Application Level
1. Primary Batteries

- ‘MgBOX’ generates electricity just by filling water.
- ‘Mg BOX’ has high-capacity enough to charge maximum 30 times for smart-phone.
- ‘Mg BOX’ is equipped with two USB type output terminals.

**Specification**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating time</td>
<td>5 days max.</td>
</tr>
<tr>
<td>Output Energy</td>
<td>300Wh</td>
</tr>
<tr>
<td>Weight</td>
<td>About 1.6kg</td>
</tr>
<tr>
<td>Output voltage</td>
<td>DC 5.0V</td>
</tr>
<tr>
<td>Maximum current</td>
<td>1.2A</td>
</tr>
</tbody>
</table>
3-3 Application Level

2. Audio equipment

- Music cable, Speaker, Speaker stands using Magnesium thin foils.
- High quality sounds by high dumping capacity.
3-3 Application Level
3. Welfare equipment

- Light & Stylish Sticks
- High performance wheel chairs

Ultra light; 6.2kg
Stylish Design
Advanced Material & Processing

 HASHIMOTO ENGINEERING CO., LTD.
3-3 Application Level
4. Construction material

Expansion Joint

- 'Expansion Joint' is a joint part for Suspended ceilings.
- Has high dumping capacity & absorbs the vibration of big earthquake to prevent the ceiling from corruption.
- For public buildings such as gymnasium of schools & City halls.

Gonda metal has gotten IMA Award on this time
The details will be reported later.
3-3 Application Level
5. Re-flow pallets

- Pallets for heat-treatment of Semi-conductors
- Easy to be heated & easy to cool down
- Easy to cut (Cutting power index: $1.0 \leftrightarrow Al: 1.8$)
- Easy to be processed by laser without deformation (Mg: Limited heat deformation)
6. Automobile parts

- Currently, Steering Wheel Core & Seat flames are the main products from Mg alloy.
- Our committee is now willing to expand the usage of Mg alloys this application such as modularized Instrument panels & Integrated casting gear box.
3-3 Application Level

7. Other applications

- The washing agent material “Mag-chan” suggests us a brand new way of thinking for Magnesium metal.
- ‘Mag-chan’ is a 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.
- You don’t need to use any chemical agent for washing clothes from now on. Good news for Chemical sensitivity people.
- Sales in Japan has reached 150,000 pieces.
3-4 Recycling

- The infrastructure for Magnesium alloy recycling has not well equipped, yet.
- Few domestic companies can recycle new developed 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.
- 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.
3-5 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’.
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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.

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.
Thank you!

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