APMA 2013

2nd International Conference on Powder Metallurgy in Asia

Xiamen, China 3–6 November 2013

Organized by
Chinese Strategic Alliance for Technological Innovation in Powder Metallurgy Industry (SATI-PM) in conjunction with Taiwan Powder Metallurgy Association (TPMA)

Endorsed by
Asian Powder Metallurgy Association (APMA)

Supported by
Japan Powder Metallurgy Association (JPMA)  Japan Society of Powder & Powder Metallurgy (JSPM)
Korean Powder Metallurgy Institute (KPMI)  Korean Powder Metallurgy Association (KPMA)
Powder Metallurgy Association in India (PMAI)  Powder Metallurgy Australia (PMA)
Malaysian Powder Metallurgy and Particulate Materials Association (MPMA)

APMA2013 Secretariat
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<table>
<thead>
<tr>
<th>Contents January - December, 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Director Report</td>
</tr>
<tr>
<td>Organization of JPMA</td>
</tr>
<tr>
<td>Board Members</td>
</tr>
<tr>
<td>JPMA Secretariat</td>
</tr>
<tr>
<td>Activities of Committees</td>
</tr>
<tr>
<td>JPMA Events and International Communications</td>
</tr>
<tr>
<td>JPMA Publications</td>
</tr>
<tr>
<td>JPMA Membership</td>
</tr>
<tr>
<td>Statistics of Japan</td>
</tr>
<tr>
<td>PM2012YOKOHAMA Review</td>
</tr>
<tr>
<td>Awards</td>
</tr>
<tr>
<td>APMA Activities</td>
</tr>
<tr>
<td>PM Production in Asia</td>
</tr>
</tbody>
</table>
First of all, I would like to express my sincere thanks to all friends for participating in PM2012 Yokohama World Congress held in October, last year. We were really glad to receive many participants from America and Europe though they traveled very far away, and also many friends from the neighboring countries in spite of presence of unrest for a great earthquake and influence of the nuclear power plant accident. Thanks to the cooperation of all the Congress related people, the Congress could finish without any big troubles, and we as an organizer enjoyed comments with satisfaction and enjoyment from many friends. Thank you very much.

The Japanese Automobile Industries as Key Industries decreased down at the bottom in May, 2011 due to the Great Earthquake, and after then they were recovering favorably up to March, 2012. However, since then, they were decreasing again, and underwent lower production than one of same period of the previous year especially because of ceasing the Government Automobile Subsidy System in September, 2012. But in the calendar year of 2012, the total Machine Parts Production was 95.0 thousand ton, which is plus 4.7% than last year.

In December, 2012, the regime has changed, and provided many economic measures, that lead increase of stock market, Yen rate down from high exchange rate, and the result, the Automobile Industries revise their profit plan. But the automobile production is increasing slowly.

Japanese PM Production owing more than 90% to Automobile Parts undergoes a transition almost same as Automobile Industries, and establishing overseas new plants or increasing their overseas production capacities according to the overseas deployments of Automobile Industries.

As for PM parts for Machinery Industries, they were not influenced tremendously by the Great Earthquake, but decreasing continuously since 2011. Though the Electric Industries showed shortly a recovering tendencies after Rehman Shock, they has decreased down at the level of depression.

The Japan Powder Metallurgy Association is trying to expand PM Product Application, to educate young engineers, and to construct new technologies under the cooperation of 12 Committees consisted of JPMA members. Also JPMA supports the APMA who was established in 2008 together with Asian PM related Associations, and is going to hold the second APMA Congress, APMA 2013 at Xiamen, China in November, this year. Taking this chance, we would like to try to exchange closely PM technology and information for developing Asian PM Industries. You are welcome to participate in this Congress to cooperate together.
Mr. Kazuyoshi Tsunoda
Representative Executive Officer, Senior Vice President & Executive Officer, General Manager, Powder Metal Products Business Sector, Automotive Products Business Headquarters, Hitachi Chemical Co., Ltd.

Mr. Kazunori Arai
Japan Powder Metallurgy Association
Permanent Board Members

Mr. Mamoru Moritani
Sumitomo Electric Industries, Ltd.

Mr. Yoshiyasu Iino
DIAMET CORPORATION

Mr. Yutaka Mizuno
FINE SINTER CO., LTD.

Mr. Isamu Kikuchi
PORITE CORPORATION

Mr. Isao Takagi
KOBE STEEL, LTD.

Mr. Carl-Gustav Eklund
Höganäs Japan K.K.

Board Members

Mr. Junichi Takahashi
IWAKI DICAST Co., Ltd.

Mr. Masaaki Matsumoto
Tungaloy Corporation

Mr. Kiyonari Nakai
Tokai Carbon Co., Ltd.

Mr. Keisuke Fukuda
Nippon Kagaku Yakin Co., Ltd.

Mr. Yoshimasa Nishimura
Fukuisinter Co., Ltd.

Mr. Akihiko Hamano
JFE Steel Corporation.

Mr. Atsumi Hatano
Daido Steel Co., Ltd.

Mr. Atsushi Nagano
Dowa Electronics Materials Co., Ltd.

Mr. Masakatsu Sato
Nippon Atomized Metal Powders Corporation

Mr. Yasuhiko Hayashi
Fukuda Metal Foil & Powder Co., Ltd.

Mr. Kazuaki Kusakari
Mitsubishi Materials Techno Corporation

Auditor

Mr. Hidefumi Katagiri
Nippon Kagaku Yakin Co., Ltd.

Mr. Akihiko Tajima
Daido Steel Co., Ltd.

JPMA Secretariat

Mr. Yusuke Watanuki (Staff)
General Assembly, Committees, Events, Web, Publication

Ms. Mikie Kuwabara (Staff)
Statistics, Events and General affairs

Ms. Tokie Sakamoto (Staff)
Accountant and General affairs
Activities of Committees

Selection Committee for Award Prize
Number of Committee Members: 14 persons

*Selection Committee for JPMA Award (Development Prize)

Chairman: Mr. Isao Takagi
(KOBE STEEL, LTD.)

New Design
Development of Variable Valve Timing Parts on the Exhaust Side for Eco-Friendly Car
DIAMET CORPORATION

Committee for Administration
Number of Committee Members: 24 persons
Sub-Committee for General Affairs
Number of Committee Members: 7 persons

*Planning and operating of the PR meeting “JPMA Awards Special Session” at JSPM Spring Meeting in May
*Planning and operating of “the 10th Research Promotion Program”
*Publication of the report “Analysis of investigation results of sintered parts demand structure 2011” in June
*Planning and operating of “PM information Exchange Meeting” and “the Technical Information Meeting”
*Support of the PM2012YOKOHAMA

Chairman: Mr. Atsushi Tamaki
(Sumitomo Electric Industries, Ltd.)

Sub-Committee for Public Relations
Number of Committee Members: 8 persons

*Planning of “Case Studies on Environment and Energy Saving” at PM2012YOKOHAMA
*Planning of “Introduction of JPMA Awards” at PM2012 YOKOHAMA
*Publication of JPMA News “Funmatsu Yakin” (No369-372)
*Publication of “Guide of P/M Plant Tour”

Chairman: Mr. Takashi Saito
(Hitachi Chemical Co., Ltd.)

2012 JPMA Annual Report
Technical Committee for Sintered Parts
Number of Committee Members: 9 persons

Chairman: Dr. Yoshimi Sugaya
(Hitachi Powdered Metals Co., Ltd.)

*Discussion of the matter for ISO/TC119/SC3 and SC5
*Cooperation of "the 10th Research Promotion Program"
*Operating of "Introduction of JPMA Awards" at PM2012 YOKOHAMA

Sub-Committee for Sintered Bearings
Number of Committee Members: 3 persons

Chairman: Mr. Sanpei Seki
(PORITE CORPORATION)

*Discussion of the matter for ISO/TC119/SC3 and SC5(Bearings)
*Deliberation of Standardization for Sintered Bearings
*Deliberation of update of JPMA website for Sintered Bearings

Technical Committee for Sintered Friction Materials
Number of Committee Members: 3 persons

Chairman: Mr. Yoshihisa Ueda
(Fine Sinter Co., Ltd.)

*Deliberation of revision for Collection of Excerpt of the Standard of Friction Material
*Exchange of Information for Friction Material
*Support of PM2012 YOKOHAMA

Technical Committee for Press Machines
Number of Committee Members: 7 persons

Chairman: Mr. Katsuo Murakami
(YOSHIZUKA SEIKI Co., Ltd.)

*Deliberation of requests of Press Machine and Compacting
*Exchange of Information for Press Technology and Compacting Technology
**Technical Committee for Metal Powders**
Number of Committee Members: 16 persons

*Chairman: Mr. Akio Sonobe (JFE Steel Corporation)*

- Completion of Domestic Standard (JIS) Draft “Flow Rate, Apparent Density and Tap Density”
- Discussion of Matter for ISO/TC119/SC2
- Introduction of topics about “Metal Powder” by Committee members and exchange of views

**Committee for Metal Injection Molding**
Number of Committee Members: 12 persons

*Chairman: Mr. Isamu Otsuka (EPSON ATMIX CORPORATION)*

- Investigation of the Japanese MIM market
- Operating on the Standardization of the *Materials Property (fatigue, impact and tensile)* with Sub-Committee for Material Characteristics
- Discussion of the matter for ISO/TC119/SC5 (ISO22068)

**Marketing Committee**
Number of Committee Members: 14 persons

*Chairman: Mr. Kimihisa Maekawa (FINE SINTER CO., LTD.)*

- Introduction of topics by Committee Members and exchange of views
- Introduction of Information Gathering of User Market and Other Market

**Committee for International Standardizations**
Number of Committee Members: 7 persons

*Chairman: Mr. Tetsuya Sawayama (KOBELCO STEEL LTD.)*

- Planning and operating of 2012 ISO/TC119 Meeting in Tokyo, Japan
- Discussion of related matters for TC119, SC2, SC3 and SC5
Committee for Environment
Number of Committee Members: 5 persons

Chairman: Mr. Masahiro Oki
(Hitachi Powdered Metals Co., Ltd.)

*Investigation of 2011 follow-up survey for "Voluntary Action Plan for Environment of PM Industry"
*Introduction of Case Study of “CO2 Emissions Reduction”, “Waste Product Reduction” and “KANKYO HIYARI”
*Operating of "Case Studies on Environment and Energy Saving" at PM2012YOKOHAMA

JPMA Events and International Communications

11, January
Gathering of 2012 New Year Greeting and Ceremony of Awarding Various Honors in 2011

16, March
The 18th Technological Information Meeting 4 research reports were presented by each winners of 9th Research Promotion Program.  
The 7th PM Information Exchange Meeting

22, May  
JPMA Special Session at the JPMA Spring Meeting

28, May
2012 JPMA General Assembly  
Mr. Kazuyoshi Tsunoda was elected as a new President.  
The 2012 Working Plans and Budget of JPMA

6, June
JPMA and SATI-PM Exchange of information meeting  
Operation of JPMA Secretariat and World Congress

22, June
Tour of Committee for Administration  
TOYOTA MOTOR CORPORATION Tawara Plant

11-13, October
ISO/TC119/2011 Meeting at Tokyo, Japan  
7 representatives of JPMA took part in this meeting for ISO/TC119, SC2, SC3 and SC5  
Support of 3 persons (Committee for International Standardizations and JPMA Secretariat)

14-18, October
2012 Powder Metallurgy World Congress & Exhibition

17, October
APMA, 4th Board Meeting  
MPIF / EPMA / JPMA Meeting

15, November
2012 JPMA Fall General Assembly  
Announcement of 2012 JPMA Awards

20, November
The 10th Research Promotion Program at the JSPM Fall Meeting

JPMA Publications

The 33th Investigation Collection Results of Sintered Parts Demand Structure
JPMA Report, 2011 (English and Japanese)  
JPMA News "Funmatsu Yakin" (No369-372)
Guide of P/M Plant Tour
PM2012YOKOHAMA Report
2012 New Members

Associate Member

**SHANDONGLAIWU JINSHI GROUP CO., LTD.**

Chuetsu Graphite Works Co., LTD.
Production of PM Products in Japan

Fig 1 shows the production volume change of Machine Parts and Bearings for the period from 2003 through 2012.

Machine Parts volume was 95,020 ton, 4.7% increase over the previous year. Bearings volume was 6,386 ton, 0.05% decrease over the previous year. As the other products, Friction Materials volume was 634 ton, 13% decrease over the previous year. Electric Contacts volume was 64 ton, 17% decrease over previous year.

Fig 1. Production of Machine Parts and Bearings (Calendar Year) (Source: METI)

Machine Parts and Bearings

Fig 2 shows the analysis of demand for Machine parts and Bearings for the period from 2003 through 2012.

Machine Parts Production volume for Vehicles was 87,691 ton, 5.8% increase previous year. This is because of the tax reduction for eco-car by government and the production increase of vehicles by new car investment. But because of the discontinuance of eco-car tax reduction in September, 2012, production volume of vehicles was decreased after the 3rd quarter. In near future, the demand will be still weak in Japan, but because of the demand increase in foreign countries and the weak Yen, the increase of export is expected.

As well as Machine Parts, Production volume of Bearings for Vehicles was 3,993 ton, 3.7% increase over the previous year.

Fig 2. Analysis of Demand for Machine Parts and Bearings (Calendar Year) (Source: METI)

Machine Parts

<table>
<thead>
<tr>
<th>Year</th>
<th>For Vehicles</th>
<th>For Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>9003</td>
<td>4971</td>
</tr>
<tr>
<td>2004</td>
<td>9371</td>
<td>4719</td>
</tr>
<tr>
<td>2005</td>
<td>9763</td>
<td>4719</td>
</tr>
<tr>
<td>2006</td>
<td>10138</td>
<td>4719</td>
</tr>
<tr>
<td>2007</td>
<td>94167</td>
<td>4719</td>
</tr>
<tr>
<td>2008</td>
<td>9003</td>
<td>4719</td>
</tr>
<tr>
<td>2009</td>
<td>7570</td>
<td>4719</td>
</tr>
<tr>
<td>2010</td>
<td>7653</td>
<td>4719</td>
</tr>
<tr>
<td>2011</td>
<td>7926</td>
<td>4719</td>
</tr>
<tr>
<td>2012</td>
<td>1025</td>
<td>4719</td>
</tr>
</tbody>
</table>

Bearings

<table>
<thead>
<tr>
<th>Year</th>
<th>For Vehicles</th>
<th>For Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>3578</td>
<td>3578</td>
</tr>
<tr>
<td>2004</td>
<td>4068</td>
<td>4068</td>
</tr>
<tr>
<td>2005</td>
<td>3993</td>
<td>3993</td>
</tr>
<tr>
<td>2006</td>
<td>3993</td>
<td>3993</td>
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<tr>
<td>2007</td>
<td>4248</td>
<td>4248</td>
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<tr>
<td>2008</td>
<td>4371</td>
<td>4371</td>
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<tr>
<td>2009</td>
<td>4207</td>
<td>4207</td>
</tr>
<tr>
<td>2010</td>
<td>4536</td>
<td>4536</td>
</tr>
<tr>
<td>2011</td>
<td>4068</td>
<td>4068</td>
</tr>
<tr>
<td>2012</td>
<td>4068</td>
<td>4068</td>
</tr>
</tbody>
</table>
Fig 3 shows the use breakdown of Machine parts and Bearings in vehicle in 2011 based on the demand structure survey by JPMA.

52.7% of Machine parts were for engine use. The main trend was for VVT and powder pressed core. The trend of machine parts for VVT was to make the high precision parts to decrease the number of parts. Powder pressed core was used for reactor core for HEV, the demand is increased and the development for performance improvement is required.

The main demand of Bearings is for electrical use. For Bearings, high precision, long life and high silence performance are required, the requirement for silence performance is very high. And especially development and use of Bearings for fuel pump of gasoline engine, that the high anti corrosion performance is required, is expected for production increase in future.

Fig 3. Breakdown of Machine Parts and Bearings for Automobile (2011)  (Source: JPMA)

Fig 4 shows the weight of sintered parts used for one car and the car production in Japan for the period from 2002 through 2011.

The weight of sintered parts used for one car in 2011 was 9.2kg in Japan, 18.9kg in U.S. and 8.8kg in Europe.

Fig 4. Weight for sintered parts used for one car (Source JPMA and JAMA)
Fig5 shows Shipment of Metal Powders.

Fig.5 Shipment of Metal Powders (Source JPMA)

Shipment of Iron Powders (Calendar Year)

Shipment of Copper Powders (Calendar Year)

Shipment of Other Powders (Fiscal Year)
Powder Metallurgy World Congress & Exhibition in 2012 was held from October 14th through 18th at Pacifico-Yokohama by the sponsorship of PMPMA and JPMA. The world congress in Japan was 3rd time. PM2012 was 12 years since the last time, and we had some minus factors like East Japan earthquake, nuclear reactor accident, high Yen ratio, depression trend in the world and political problem between Japan and China. But this congress was held under the success.

Total attendees were 734 from all over the world. In that, the attendees of Congress were 701 and the companions were 33. The Congress attendees from foreign countries were 320, in that 104 from Asia, 153 from Europe, 46 from North America and 17 from other area. The attendees from Japan were 414. Persons in charge for exhibition were 766 and visitors only for the exhibition were 1209. Total attendees were about 2700.
Awards

Personal Prize
The late Mr. Minoru Nishimura
Former Chairman of FUKUSHINTER CO., LTD.
2002-2012 Board Member

Development Prize
A New Design

A-1
Development of Variable Valve Timing Parts on the Exhaust Side for Eco-Friendly Car

A-2
Development of sintered bearings for the poppet valves for EGR system

A-3
The development of a complicated shape part for torque converter by utilizing CNC compacting technique

A-4
Development of Sintered Coupling for Engine Balancer for Clean Diesel Vehicle
### A-5
**Development of additional function to the parking support parts for CVT**

Hitachi Chemical Co., Ltd.

### A-6
**Development of the powder metal part for the lightweight centrifugal clutch**

Hitachi Chemical Co., Ltd.

### B-1
**Low-noise oil-impregnated bearing for fan motor of super-slim mobile note PC**

PORITE CORPORATION

### D-1
**Segregation-free mixed powder for free-cutting to achieve a sintered material with excellent drilling performance**

JFE Steel Corporation

### F-1
**Development of precision cam sprocket with sensors for an idle reduction system.**

Sumitomo Electric Industries, Ltd.

### F-2
**The valve seat material of adding higher wear resistant hard particles**

FINE SINTER CO., LTD.

### F-3
**Sintered brake lining for high-speed railroad vehicles on local lines**

FINE SINTER CO., LTD.
Prize for Distinguish Service of the Committee Activities

Mr. Norihisa Ambiru
Mitsui Mining & Smelting Co., Ltd.

2003-2012
Member of Committee for Administration
2010-2012
Member of PM2012 Steering Committee

Recognition of Superior Employees

2012 prizewinner numbered 17 persons
(12 member companies)

Encouragement Prize at Research Promotion Program

12 Research Reports were presented with posters, and 4 Reports were elected for encouragement prize
The 4th Board Meeting
Date: Wednesday 17th October 2012  10:00 - 12:00
Venue:  Pacifico YOKOHAMA  Room211+ 212, Conference Center
Participants :
APMA Board Member
President       Mr. Isamu Kikuchi (JPMA, Japan)
Director        Prof. Jai Sung Lee (KPMA, Korea)
Director        Mr. Chiu-Lung Chu (TPMA, Taiwan)
Director        Mr. N. Gopinath (PMAI, India)
Director        Dr. Han Wei (SATI-PM, China)
Auditor         Prof. Hideshi Miura (JSPM, Japan)
Secretariat     Mr. Kazunori Arai (JPMA, Japan)
Interpreter    Mr. Takashi Saito (JPMA, Japan)

Conclusion
*2012 Finance and 2013 Budget was approved
*Board Members was elected
  Mr. Isamu Kikuchi was elected as a President.
*The APMA Join of CPMS, PMA, and MPM2A was approved
*Confirmation of the APMA2013 cooperation
*The host countries of PM2018 was decided as a china

APMA 2013 Information
2nd International Conference Powder Metallurgy in Asia
4-6 November 2013 Xiamen, China
www.apma2013.org
## PM Production in Asia

PM Production (Source JPMA, PMAI, KPMI, TPMA and CMPMA)

<table>
<thead>
<tr>
<th>AREA</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>12/11(%)</th>
</tr>
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<tbody>
<tr>
<td>Japan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron-base</td>
<td>98,899</td>
<td>93,538</td>
<td>96,979</td>
<td>103.7</td>
</tr>
<tr>
<td>Copper-base</td>
<td>3,624</td>
<td>3,567</td>
<td>4,427</td>
<td>124.1</td>
</tr>
<tr>
<td>Total</td>
<td>102,523</td>
<td>97,105</td>
<td>101,406</td>
<td>104.4</td>
</tr>
<tr>
<td>China</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron-base</td>
<td>128,185</td>
<td>134,544</td>
<td>129,485</td>
<td>96.2</td>
</tr>
<tr>
<td>Copper-base</td>
<td>8,961</td>
<td>8,884</td>
<td>10,011</td>
<td>112.7</td>
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<tr>
<td>Total</td>
<td>137,146</td>
<td>143,428</td>
<td>139,496</td>
<td>97.3</td>
</tr>
<tr>
<td>Korea</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>*Iron-base</td>
<td>58,355</td>
<td>62,543</td>
<td>64,026</td>
<td>102.4</td>
</tr>
<tr>
<td>Copper-base</td>
<td>1,758</td>
<td>1,318</td>
<td>1,209</td>
<td>91.7</td>
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<tr>
<td>Total</td>
<td>60,113</td>
<td>63,861</td>
<td>65,235</td>
<td>102.1</td>
</tr>
<tr>
<td>Taiwan</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Iron-base</td>
<td>24,000</td>
<td>27,000</td>
<td>26,000</td>
<td>96.3</td>
</tr>
<tr>
<td>Copper-base</td>
<td>1,800</td>
<td>1,800</td>
<td>1,200</td>
<td>66.7</td>
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<tr>
<td>Total</td>
<td>25,800</td>
<td>28,800</td>
<td>27,200</td>
<td>94.4</td>
</tr>
<tr>
<td>India</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Iron-base</td>
<td>31,200</td>
<td>35,400</td>
<td>37,000</td>
<td>104.5</td>
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<tr>
<td>Copper-base</td>
<td>13,700</td>
<td>14,500</td>
<td>14,500</td>
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<tr>
<td>Total</td>
<td>44,900</td>
<td>49,900</td>
<td>51,500</td>
<td>103.2</td>
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<tr>
<td>Malaysia</td>
<td></td>
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</tr>
<tr>
<td>Iron-base</td>
<td>6,123</td>
<td>6,009</td>
<td>5,335</td>
<td>88.8</td>
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<tr>
<td>Copper-base</td>
<td>133</td>
<td>162</td>
<td>244</td>
<td>150.6</td>
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<tr>
<td>Total</td>
<td>6,256</td>
<td>6,171</td>
<td>5,579</td>
<td>90.4</td>
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<tr>
<td>Singapore</td>
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<tr>
<td>Iron-base</td>
<td>1,595</td>
<td>1,744</td>
<td>1,413</td>
<td>81.0</td>
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<tr>
<td>Copper-base</td>
<td>636</td>
<td>674</td>
<td>654</td>
<td>97.0</td>
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<tr>
<td>Total</td>
<td>2,231</td>
<td>2,418</td>
<td>2,067</td>
<td>85.5</td>
</tr>
<tr>
<td>Thailand</td>
<td></td>
<td></td>
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<tr>
<td>Iron-base</td>
<td>15,350</td>
<td>15,401</td>
<td>16,029</td>
<td>104.1</td>
</tr>
<tr>
<td>Copper-base</td>
<td>29</td>
<td>145</td>
<td>6</td>
<td>4.1</td>
</tr>
<tr>
<td>Total</td>
<td>15,379</td>
<td>15,546</td>
<td>16,035</td>
<td>103.1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron-base</td>
<td>363,707</td>
<td>376,179</td>
<td>376,267</td>
<td>100.0</td>
</tr>
<tr>
<td>Copper-base</td>
<td>30,641</td>
<td>31,050</td>
<td>32,251</td>
<td>103.7</td>
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<tr>
<td>Total</td>
<td>397,318</td>
<td>407,229</td>
<td>408,518</td>
<td>100.3</td>
</tr>
</tbody>
</table>

*Included “Others”
## Application Field Ratio of PM Production (2012) (%)

<table>
<thead>
<tr>
<th>AREA</th>
<th>For Transportation Machines</th>
<th>For Industrial Machines</th>
<th>For Electrical Machines</th>
<th>For Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>92</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>China</td>
<td>58</td>
<td>2</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Korea</td>
<td>88</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Taiwan</td>
<td>40</td>
<td>24</td>
<td>7</td>
<td>29</td>
</tr>
<tr>
<td>India</td>
<td>78</td>
<td>5</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>Malaysia</td>
<td>61</td>
<td>3</td>
<td>36</td>
<td>0</td>
</tr>
<tr>
<td>Singapore</td>
<td>42</td>
<td>6</td>
<td>52</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>89</td>
<td>4</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

PM Production of Asia in the World (Source MPIF, EPMA and JPMA)
*North America & Europe, based on Shipment of Fe & Cu Powder for PM Use

(Metric tons)
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