Dear Friends:

We thank you heartily for your cooperation and assistance with our activities in the last year. The Japanese Powder Metallurgy Industries could have the relatively blessed year due to the favorable progress of the Japanese Automobile and Machinery production.

【JPMA Topics of 2017】

In January 2017, we had a new year greeting party, when various award ceremonies were performed. An environmental award was newly set up, and its first awards were granted to member’s factories achieved the highest reduction rate for CO$_2$ and industrial wastes respectively. JPMA will progress activities of the CO$_2$ and industrial waste reduction for the protection of the global environment.

In March, in order to promote a rationalization for dealings between automobile industries and powder metallurgy industries, we have formulated a dealing rationalization guideline for mold management of extracting and scrapping unnecessary molds, and a system to follow up those rationalization progress, whose activities are under promotion.

In April, the APMA2017 Conference was held in Taiwan, and many JPMA members attended. During the conference, APMA Board Meeting decided newly Thailand Powder Metallurgy Association to join in APMA, hereby the APMA becomes constituted with 6 territories of China, India, Japan, Korea, Taiwan, and Thailand. It was decided that at the time of World PM2018 Beijing, the chairman of APMA will be changed from Mr. Kikuchi of JPMA to Mr. Chu of TPMA.

【Japanese Powder Metallurgy Products of the year 2017】

Concerning Japanese industries in 2017, export and production activities were headed to recovering as economic deceleration of China and Asian countries were moderated, European economy was improved, and American economy was steady. Also, Japanese consumption was gently turned to recover, due to steady employment and consumer spending situation.

Under such favorite economic situation, local automobile production was 9.69 million cars, which was as +5.3% than 2016 production. Its increased factors relied on new cars equipped with low fuel ratio technologies, and preventive safety technologies, whose locally sold number became over 5million, and exported number also increased.

The production of automobile related sintered parts, which shares 90% of sintered mechanical parts, increased just as automobile production numbers, and their weight was 88.5 thousand tons, which was +4.0% than 2016 production weight.

JPMA really hope promotion and expansion of PM industries, through cooperation between each Association members, PM technology promotion, cultivation of human resource, and cooperation with world PM industries. Your warm support to us would be much appreciated.

Mr. Tetsuya Hayashi  
SUMITOMO ELECTRIC INDUSTRIES LTD.

Mr. Mutsumi Yasutake  
DIAMET CORPORATION

Mr. Takuya Hirano  
Hitachi Chemical Co., Ltd.

Mr. Yoichi Inoue  
FINE SINTER CO., LTD.

Mr. Shinichi Kondo  
KOBE STEEL, LTD.

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

Mr. Junichi Takahashi  
IWAKI DIECAST Co., Ltd.

Mr. Mikio Fujihara  
Tungaloy Corporation

Mr. Hiroshi Takahashi  
Tokai Carbon Co., Ltd.

Mr. Masayoshi Nishimura  
Fukuisinter Co., Ltd.

Mr. Jun Kadota  
JFE Steel Corporation

Mr. Yoshiaki Mori  
Daido Steel Co., Ltd.

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

Mr. Masanori Kishima  
Nippon Atomized Metal Powders Corporation

Mr. Syuzo Sonoda  
FUKUDA METAL FOIL & POWDER CO., LTD.

Mr. Masanori Uchida  
Mitsubishi Materials Techno Corporation

Mr. Masaaki Matsumoto  
Tungaloy Corporation

Mr. Toshiharu Takahashi  
Dowa Electronics Materials Co., Ltd.

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

Ms. Tokie Sakamoto (Staff)  
Accountant and General affairs

Ms. Aoi Yamanaka (Staff)  
Statistics, Events 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. Carl-Gustav Eklund
(Höganäs Japan K.K.)
New Chairman

New Design
Development of low-cost Sintered Ravigneaux Planetary Carrier.
TOYOTA MOTOR CORPORATION

Committee for Administration
Number of Committee Members: 22 persons

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

Chairman: Mr. Kazunori Kato
(FINE SINTER CO., LTD.)
Commission from 2016

*Planning and operating of the PR meeting “JPMA Awards Special Session” at JSPM Spring Meeting in May
*Planning and operating of “the tour of Committee for Administration”.
*Publication of the report “Analysis of investigation results of sintered parts demand structure 2016” in June.
*Planning and operating of “19th Metal Powder and Equipment PR Meeting” and “35th Case Studies on Improving Production Efficiency Meeting” in November.
*Planning and operating of “PM information Exchange Meeting”.

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

Chairman: Mr. Sanpei Seki
(PORITE CORPORATION)
Commission from 2016

*Planning of operating of “5th Human resources development seminar”.
*Publication of JPMA News “Funmatsu Yakin” (No389-392).
Technical Committee
for Sintered Parts
Number of Committee Members: 9 persons

*Discussion of the matter for ISO/TC119 and SC3.
*Update of the JPMA Standard (Fatigue test pieces and Tensile test pieces).
*Deliberation of enactment of the JPMA Technical Report.
*Planning and operating of “Joint Meeting by the three Technical Committees”.
*Planning and operating of the Plant tour for new markets.

Chairman: Mr. Nozomu Yatagai
(PORITE CORPORATION)
New Chairman

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

*Deliberation of standardization of the PV value.
*Deliberation of the appropriate inter laboratory tests of the PV value.
*Deliberation of update of Bearings Website.

Chairman: Mr. Yoshinari Ishii
(DIAMET CORPORATION)
Commission from 2014

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

*Exchange of Information on Friction Material.
*Planning and operating of “Opinion Exchange Meeting among Young Workers of Sintered Friction Materials Companies”.
*Deliberation of update of the basic texts for Sintered Friction Material.

Chairman: Mr. Yoshihisa Ueda
(FINE SINTER CO., LTD.)
Commission from 2010

Technical Committee
for Press Machines
Number of Committee Members: 6 persons

*Exchange on Information for defect cases of Press.
*Exchange on Information for newfangled Press Machines.
*Planning and operating of “Joint Meeting by the three technical committees”.

Chairman: Mr. Hideo Sato
(Mitsubishi Materials Techno Corporation)
Commission from 2016

2017 JPMA Annual Report
**Technical Committee for Metal Powders**
Number of Committee Members: 15 persons

*Introduction of topics about “Metal Powder” by the Committee members and exchange of views mutually.
*Planning and operating of “Joint Meeting by the three technical committees”.
*Verification of measurement difference of Laser diffraction methods.

**Committee for Metal Injection Molding**
Number of Committee Members: 11 persons

*Investigation of the Japanese MIM market.
*Planning and operating of MIM PR seminar.
*Planning and operating of “MIM Lecture Meeting for Users” and “Opinion Exchange Meeting among Young Workers of MIM Companies”.

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

*Introduction of topics about “P/M market” by the Committee Members and exchange of views mutually.
*Introduction of gathering Informations of User Market and Other Market.
*Deliberation of update of the P/M Roadmap.

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

*Attendance of 2017 ISO/TC119 Meeting in Madrid, Spain.
*Discussion of related matters for TC119/WG2, WG3, SC2 and SC3.
Committee for Environment
Number of Committee Members: 5 persons

*Introduction of Case Studies of “CO₂ Emissions Reduction”, “Waste Product Reduction” and “KANKYO HIYARI”.
*Selection of the “Environment Awards”.
*Planning of the “Environment Logo Mark”.

Chairman: Mr. Motonobu Isaka
(DIAMET CORPORATION)
Commission from 2014

JPMA Events and International Communications

11, January

17, March
The 12th PM Information Exchange Meeting.

9-11, April
4th International Conference on Powder Metallurgy in Asia (APMA2017Taiwan).

11, April
APMA, 9th Board Meeting.

19, May
2017 JPMA General Assembly.
The 2017 Activity Plans and Budget of JPMA.

31, May
JPMA Special Session at the JSPM Spring Meeting.

8, June
Tour of Committee for Administration.
SUBARU Yajima Plant.

7, July
5th Human resources development seminar.

9, August
Tour of Technical Committee for Sintered Parts.
Panasonic Corporation Eco Solutions Company.

25, August
Preparation Meeting of World PM2018 Beijing.
China National Conference Center.

8, September
The 3rd Opinion Exchange Meeting among Young Workers of Sintered Friction Materials.

21-22, September
The 8th Opinion Exchange Meeting among Young Workers of MIM Companies.

19, October
2017 JPMA Fall General Assembly.
Announcement of 2017 JPMA Awards.

6-10, November
JSPM 60th Anniversary Ceremony.

17, November
The 35th Case Studies of Production Efficiency Improvement Meeting and the 20th Metal Powder and Equipment PR Meeting.

JPMA Publications

The 38th Investigation Collection Results of Sintered Parts Demand Structure.
JPMA News “Funmatsu Yakin” (No389-392).
JPMA Standard (JPMA M04 and JPMA M06).
Production of PM Products in Japan

Fig 1 shows the production volume change of Machine Parts and Bearings for the period from 2008 through 2017.

In 2017, Machine Parts volume was 88,484 ton, 4.0% increase from the previous year. Bearings volume was 6,741 ton, 8.3% increase from the previous year. As the other products, Friction Materials volume was 723 ton, 21.3% increase from the previous year. Electric Contacts volume was 72 ton, 10.8% increase from the previous year.

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

Statistics of Japan

JPMA Membership

- Regular Member: 36
- Associate Member: 28
- Equipment Manufacturers: 12
- Metal Powder Manufacturers: 12
- Equipment Manufacturers: 6
- Special Member: 2
- Complimentary Member: 2
- Overseas Member: 5
- Trading Companies & Others: 22
- Total: 66

PM Products Manufacturers: 18

Production of PM Products in Japan

Fig 1 shows the production volume change of Machine Parts and Bearings for the period from 2008 through 2017.

In 2017, Machine Parts volume was 88,484 ton, 4.0% increase from the previous year. Bearings volume was 6,741 ton, 8.3% increase from the previous year. As the other products, Friction Materials volume was 723 ton, 21.3% increase from the previous year. Electric Contacts volume was 72 ton, 10.8% increase from the 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 2008 through 2017.

In 2017, Machine Parts Production volume for Vehicles was 83,173 ton, 3.4% increase from the previous year.

Such increase was driven by domestic vehicle production volume in 2017 which was 5.3% increase from the previous year. There were two major factors for increase of domestic vehicle production, one was recovery of domestic and international economy, and second was several new vehicle release with high mileage and safety performance.

Domestic vehicle production volume in 2018 is forecasted same level of 2017 against expectation of sustainable economic growth, because there is uncertainly international geopolitical risk and trade friction.

Production volume of Bearings for Vehicles was 4,269 ton, 6.0% increase from the previous year. Bearings expanded their business in 2017 thanks to increase of motor driving devices in a vehicle and active demand of the bush for turbo charger unit.

It seems to be still good year for bearings in 2018.
Fig3 shows the use breakdown of Machine Parts and Bearings in vehicle in 2016 based on the demand structure survey by JPMA.

54.1% of Machine parts were for engine use in 2016, Although there is no change in the application field of Machine Parts, in case of Bearing, the usages of electrical field would increase due to the tendency of increasing motor driving devices in a vehicle. Also, we pay attention to the market expansion of the bearings with high heat resistant, because high heat resistant bearings are needed for engine unit.

Fig3. Breakdown of Machine Parts and Bearings for Vehicles (2016)  (Source: JPMA)

Fig4 shows the weight of sintered parts calculated for one car and the car production in Japan for the period from 2007 through 2016.

The weight of sintered parts calculated for one car in 2016 was 8.7kg in Japan, 20.0kg in U.S. and 8.3kg in Europe.

Fig4. Weight for sintered parts calculated for one motor car (Source JPMA and JAMA)
Fig5 shows Shipment of Metal Powders.

![Shipment of Metal Powders](source: JPMA)

**Shipment of Iron Powders (Calendar Year)**

<table>
<thead>
<tr>
<th>Year</th>
<th>For PM</th>
<th>For Others</th>
<th>Export</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>42954</td>
<td>55683</td>
<td>108883</td>
</tr>
<tr>
<td>2014</td>
<td>48119</td>
<td>63868</td>
<td>107642</td>
</tr>
<tr>
<td>2015</td>
<td>44725</td>
<td>54104</td>
<td>107105</td>
</tr>
<tr>
<td>2016</td>
<td>47799</td>
<td>50384</td>
<td>105769</td>
</tr>
<tr>
<td>2017</td>
<td>46510</td>
<td>55006</td>
<td>112296</td>
</tr>
</tbody>
</table>

**Shipment of Copper Powders (Calendar Year)**

<table>
<thead>
<tr>
<th>Year</th>
<th>For PM</th>
<th>For Others</th>
<th>Export</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>1002</td>
<td>1102</td>
<td>4848</td>
</tr>
<tr>
<td>2013</td>
<td>1101</td>
<td>1126</td>
<td>4768</td>
</tr>
<tr>
<td>2014</td>
<td>1177</td>
<td>1181</td>
<td>5081</td>
</tr>
<tr>
<td>2015</td>
<td>1017</td>
<td>1109</td>
<td>4662</td>
</tr>
<tr>
<td>2016</td>
<td>1070</td>
<td>1161</td>
<td>4514</td>
</tr>
</tbody>
</table>

**Shipment of Other Powders (Fiscal Year)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Stainless steel powder</th>
<th>MIM powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>2841</td>
<td>389</td>
</tr>
<tr>
<td>2012</td>
<td>3014</td>
<td>313</td>
</tr>
<tr>
<td>2013</td>
<td>2893</td>
<td>281</td>
</tr>
<tr>
<td>2014</td>
<td>2033</td>
<td>359</td>
</tr>
<tr>
<td>2015</td>
<td>2596</td>
<td>320</td>
</tr>
<tr>
<td>2016</td>
<td>3103</td>
<td>366</td>
</tr>
</tbody>
</table>
Awards

Development Prize
A New Design

A-1
Development of low-cost Sintered Ravigneaux Planetary Carrier

TOYOTA MOTOR CORPORATION

A-2
Development of Complex Shaped Pulley with High Accuracy Non-circular gear teeth

SUMITOMO ELECTRIC INDUSTRIES, LTD.

A-3
Development of the sprocket drive for low fuel consumption AT oil pump

DAIAMET CORPORATION
B New Materials

B-1
High wear resistant Fe-sintered alloy slider for high speed trains

FINE SINTER CO., LTD.

B-2
Development of Fe-Cu system Oil-impregnated Sintered Bearing with Excellent High Pressure Resistance and Wear Resistance

DAIAMET CORPORATION

F Effort Prize

F-1
Development of Gasoline Direct Injection Mechanism Part `Guide, Fuel Pump Lifter

SUMITOMO ELECTRIC INDUSTRIES, LTD.
F-2
Development of thin sprocket without sizing process

DAIAMET CORPORATION

Prize for Distinguished Service of the Committee Activities
Mr. Hideo Kato
FUKUDA METAL FOIL & POWDER CO., LTD.
1992-2016
Member of Committee for Administration
Member of Sub-Committee for General Affairs
Member of Sub-Committee for Public Relations
Member of Marketing Committee
Member of Committee for Metal Injection Molding
Chairman of Sub-Committee for PM2012
Member of Committee for 50th and 60th Anniversary Edit

Dr. Kinya Kawase
DAIAMET CORPORATION
2007-2017
Chairman and Member of Technical Committee
for Sintered Parts
Member of Committee for International Standardizations
Member of Selection Committee for Award Prize
Member of Committee for JIS Draft

Mr. Akio Sonobe
JFE Steel Corporation
2008-2017
Chairman and Member of Technical Committee
for Metal Powders
Member of Marketing Committee
Member of Selection Committee for Award Prize
Member of Committee for JIS Draft
Recognition of Superior Employees
2017 prizewinner numbered 18 persons
(13 member companies)

Environment Prize
Reduction of CO₂ basic unit
FINE SINTER CO., LTD.
Yamashina Plant

Reduction for total waste basic unit
NAPAC Co., Ltd.
The 9th Board Meeting
Date: Tuesday 11 April 2017 13:30-15:00
Venue: Peace Room 4th Floor Sheraton Hsinchu Hotel, Taiwan
Participants:
APMA Board Member
- President: Isamu Kikuchi (JPMA, Japan)
- Director: Rang Cai (CPMA, China)
- Director: Chiu-Lung Chu (TPMA, Taiwan)
- Director: N. Gopinath (PMAI, India)
- Auditor: Akira Kawasaki (JSPM, Japan)
- Secretariat: Takashi Saito (JPMA, Japan)

Attendant of APMA Members Association
- CPMA(China): Rang Cai (President), Han Wei (Secretary General), Yang Yu (Vice Secretary General)
- CPMS(China): Xiang Xiong (Director), Bin Liu, Hong Wu
- JPMA(Japan): Isamu Kikuchi (President), Takashi Saito (Executive Director), Sanpei Seki (Chairman of Public Relations Committee), Aoi Yamanaka (Secretary, Planning and Statistics)
- JSPM(Japan): Akira Kawasaki (President), Yoko Inoue (Secretary General)
- KPMA(Korea): Sung Hwan An (Vice Chairman), Joon Park (Director)
- KPMI(Korea): Yong Jln Kim (President), Hyoung Seop Kim (Vice President), Young Do Kim (Former President), Jai Sung Lee (Former President), Chang Kyu Lee (Director)
- PMAI(India): N.Gopinath (President), Aniket Gore (Vice President), Deepak Grover (Vice President)
- TPMA(Taiwan): Chiu Lung Chu (President), Sea Fue Wang (Vice President), S J Liao (Secretary General), H L Lee (Supervisor)
- ThaiPMA(Thailand): Ruangdaj Tongsri (President), Boon Teeraprawatekul (Secretary General)

Conclusions
- 2016 Finance and 2017 Budget was approved
- Report of APMA2017 Taiwan
- Introduction of the World PM2018 Beijing preparations situation
- Report of APMA2019 Conference (India) preparations situation
- ThaiPMA approval as member of APMA
- Mr. Chu (TPMA) approval as new president of APMA (President change at World PM2018)
APMA2017 (the 4th International Conference on Powder Metallurgy in Asia), organized by TPMA (Taiwan Powder Metallurgy Association), was held on 9 to 11/Apr., at Sheraton Hsinchu Hotel. 469 people, mainly from Asia, participated. The main participating countries are as follows.

<table>
<thead>
<tr>
<th>Aria Participants</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Taiwan</td>
<td>155</td>
</tr>
<tr>
<td>China</td>
<td>127</td>
</tr>
<tr>
<td>Japan</td>
<td>89</td>
</tr>
<tr>
<td>Korea</td>
<td>47</td>
</tr>
<tr>
<td>India</td>
<td>4</td>
</tr>
<tr>
<td>Others</td>
<td>47</td>
</tr>
</tbody>
</table>

The Conference started with registration on 9/Apr., and an opening ceremony, a PM forum, invitation lectures and presentations of research report were held on 10/Apr., and invitation lectures and presentations of research report were held on 11/Apr..

- Opening ceremony and PM Forum
  At the opening ceremony, Mr. Chiu, Chairman of Organizing Committee, made welcome speech and introduced the attended VIPs, and then Mr. Kikuchi, Chairman of APMA, made greeting speech.

- Plenary Lecture
  At Plenary Lectures, four kind of themes, consist of Soft Magnetic Composites, Ti-6Al-4V alloy, Furnaces and Industry 4.0 (PM Industry), were lectured.

- Presentation of Research report
  Presentation of Research report, total 360 reports were presented. In that, Oral presentation were 264 and Poster presentation were 96.

- Exhibition
  Exhibition was held at two venues. Total 50 companies exhibited, consist of "major European & US P/M makers and major domestic P/M makers mainly", raw material suppliers, equipment makers and P/M makers.

- Gala Dinner
  Gala Dinner was started by the greeting speeches of Mr. Chiu, Chairman of Organizing Committee, and Mr. Kikuchi, Chairman of APMA. The presenters of superior research report received honor afterwards. And letters of thanks were conferred on the companies who cooperated with success of APMA2017 much.
### PM Production in Asia

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

<table>
<thead>
<tr>
<th>AREA</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>17/16(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron-base</td>
<td>89,123</td>
<td>88,145</td>
<td>92,166</td>
<td>104.6</td>
</tr>
<tr>
<td>Copper-base</td>
<td>3,449</td>
<td>3,121</td>
<td>3,059</td>
<td>98.0</td>
</tr>
<tr>
<td>Total</td>
<td>92,572</td>
<td>91,266</td>
<td>95,225</td>
<td>104.3</td>
</tr>
<tr>
<td>China</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron-base</td>
<td>146,153</td>
<td>156,525</td>
<td>169,636</td>
<td>108.4</td>
</tr>
<tr>
<td>Copper-base</td>
<td>12,457</td>
<td>12,669</td>
<td>15,535</td>
<td>122.6</td>
</tr>
<tr>
<td>Total</td>
<td>158,610</td>
<td>169,194</td>
<td>185,171</td>
<td>109.4</td>
</tr>
<tr>
<td>Korea</td>
<td>*Iron-base</td>
<td>67,617</td>
<td>64,086</td>
<td>68,917</td>
</tr>
<tr>
<td>Copper-base</td>
<td>640</td>
<td>633</td>
<td>435</td>
<td>68.7</td>
</tr>
<tr>
<td>Total</td>
<td>68,257</td>
<td>64,719</td>
<td>69,352</td>
<td>107.2</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Iron-base</td>
<td>30,680</td>
<td>30,000</td>
<td>32,637</td>
</tr>
<tr>
<td>Copper-base</td>
<td>2,100</td>
<td>2,000</td>
<td>2,070</td>
<td>103.5</td>
</tr>
<tr>
<td>Total</td>
<td>32,780</td>
<td>32,000</td>
<td>34,707</td>
<td>108.6</td>
</tr>
<tr>
<td>India</td>
<td>Iron-base</td>
<td>30,500</td>
<td>30,000</td>
<td>33,600</td>
</tr>
<tr>
<td>Copper-base</td>
<td>10,000</td>
<td>6,000</td>
<td>7,200</td>
<td>120.0</td>
</tr>
<tr>
<td>Total</td>
<td>40,500</td>
<td>36,000</td>
<td>40,800</td>
<td>113.3</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Iron-base</td>
<td>4,186</td>
<td>3,810</td>
<td>3,744</td>
</tr>
<tr>
<td>Copper-base</td>
<td>136</td>
<td>116</td>
<td>85</td>
<td>73.3</td>
</tr>
<tr>
<td>Total</td>
<td>4,322</td>
<td>3,926</td>
<td>3,829</td>
<td>97.5</td>
</tr>
<tr>
<td>Singapore</td>
<td>Iron-base</td>
<td>1,452</td>
<td>1,486</td>
<td>1,542</td>
</tr>
<tr>
<td>Copper-base</td>
<td>498</td>
<td>438</td>
<td>404</td>
<td>92.2</td>
</tr>
<tr>
<td>Total</td>
<td>1,950</td>
<td>1,924</td>
<td>1,946</td>
<td>101.1</td>
</tr>
<tr>
<td>Thailand</td>
<td>Iron-base</td>
<td>16,074</td>
<td>17,141</td>
<td>16,498</td>
</tr>
<tr>
<td>Copper-base</td>
<td>7</td>
<td>8</td>
<td>66</td>
<td>825.0</td>
</tr>
<tr>
<td>Total</td>
<td>16,081</td>
<td>17,149</td>
<td>16,564</td>
<td>96.6</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Iron-base</td>
<td>3,992</td>
<td>5,444</td>
<td>6,134</td>
</tr>
<tr>
<td>Copper-base</td>
<td>83</td>
<td>68</td>
<td>96</td>
<td>141.2</td>
</tr>
<tr>
<td>Total</td>
<td>4,075</td>
<td>5,512</td>
<td>6,230</td>
<td>113.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Iron-base</strong></td>
<td><strong>389,777</strong></td>
<td><strong>396,637</strong></td>
<td><strong>424,874</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Copper-base</strong></td>
<td><strong>29,370</strong></td>
<td><strong>25,053</strong></td>
<td><strong>28,950</strong></td>
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<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>419,147</strong></td>
<td><strong>421,690</strong></td>
<td><strong>453,824</strong></td>
</tr>
</tbody>
</table>

*Included “Others”
### Application Field Ratio of PM Production (2017) (%)

<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>94.3</td>
<td>4.8</td>
<td>0.6</td>
<td>0.3</td>
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<tr>
<td>China</td>
<td>62.0</td>
<td>2.0</td>
<td>25.0</td>
<td>11.0</td>
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<tr>
<td>Korea</td>
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<td>0.0</td>
<td>3.0</td>
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<td>44.0</td>
<td>26.0</td>
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<td>5.0</td>
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<tr>
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<td>1.9</td>
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<tr>
<td>Singapore</td>
<td>52.5</td>
<td>3.2</td>
<td>42.9</td>
<td>1.4</td>
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<tr>
<td>Thailand</td>
<td>91.8</td>
<td>1.1</td>
<td>7.1</td>
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<tr>
<td>Indonesia</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>