

# **Permanent Magnets 2010-2020**

**Magnetics 2011 Conference**

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**San Antonio, Texas**

*Presented by*

***Walter T. Benecki***

# **Permanent Magnets 2010-2020**

***A Comprehensive Overview  
of the Global Permanent  
Magnet Industry***

*Authored by*

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# Book Overview

- **400 Pages**
- **Professionally Bound**
- **Printed in Color**
- **1000+ Man-hours**
- **Approximately 170 References**
- **Started February 2010**
- **Published November 2010**

# Book Overview

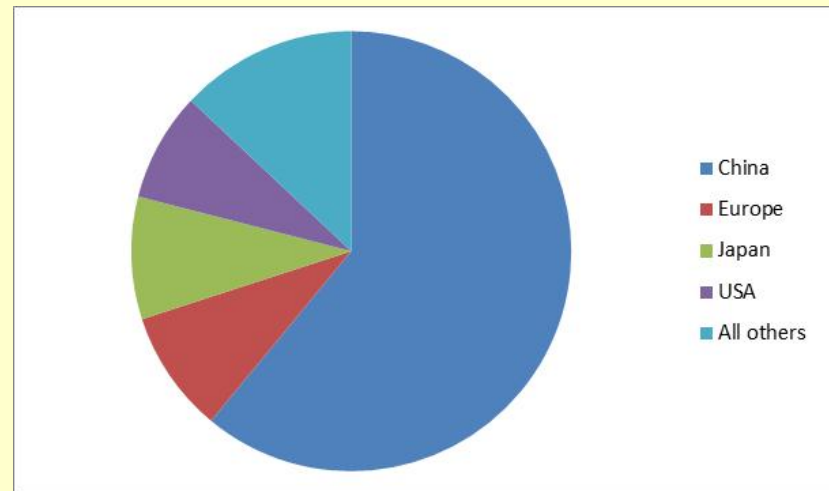
- **Industry Statistics 2005-2009**
- **Industry Production Forecast 2010-2020**
- **Current & Future Applications & Technologies**
- **China's Future Industry Status**
- **Major Magnet Industry Patents**
- **Raw Material Issues**
- **Human Resource Issues**
- **Major University Research Initiatives**
- **Magnet Industry Associations**
- **Directory of Producers, Fabricators & Distributors**
- **Directory of Magnetic Powder Producers**
- **Directory of Industry Service Providers**
- **Appendices**

# **Section 1.0 – 2005-2009 Production Statistics**

- Value & Tonnage By Magnet Type**
  - Ferrite
  - NdFeB
  - SmCo
  - Alnico
- Value & Tonnage By Geographic Region**
  - China
  - Europe
  - Japan
  - USA
  - All others
- Tonnage Market Share by Geographic Region**

# Section 1.0 - Highlights

- **Total Market 2009 - \$7.4 Billion**
- **2008-2009 Recession was Significant**
- **2009 Market Shares (based on tonnage)**
  - **China – 61%**
  - **Europe – 9%**
  - **Japan – 9%**
  - **USA – 8%**
  - **All others – 13%**

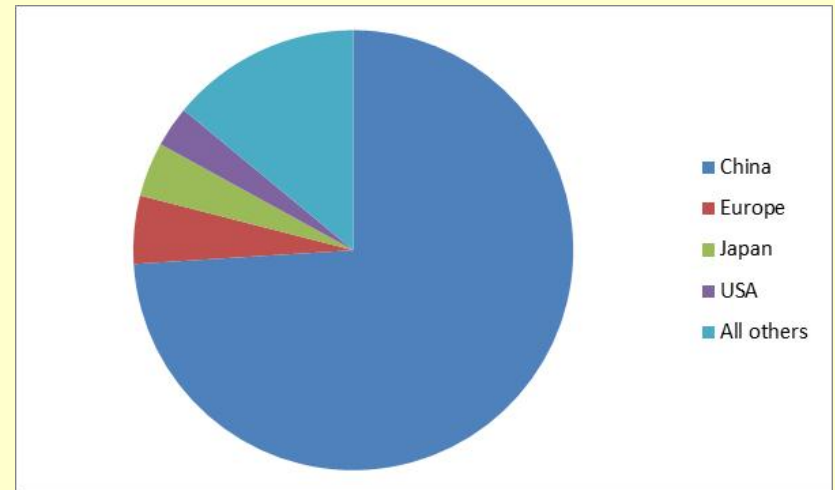


# **Section 2.0 – 2010-2020 Production Forecast**

- Value & Tonnage By Magnet Type**
  - NdFeB
  - SmCo
  - Alnico
  - Ferrite
- Value & Tonnage By Geographic Region**
  - China
  - Europe
  - Japan
  - USA
  - All others
- Value & Tonnage Share by Geographic Region**

# Section 2.0 - Highlights

- **Total 2020 Market - \$17.2 Billion**
- **2020 Market Shares (by tonnage)**
  - **China – 74%**
  - **Europe – 5%**
  - **Japan – 4%**
  - **USA – 3%**
  - **All others – 14%**





# Section 3.0

## Applications & Technology

<b>Computers</b>	<b>Motors</b>	<b>Automotive</b>	<b>Bicycles</b>
<b>Appliances</b>	<b>HVAC</b>	<b>Speakers</b>	<b>Wind Turbines</b>
<b>Sensors</b>	<b>MRI</b>	<b>Separation Equipment</b>	<b>Consumer Electronics</b>
<b>Advertising</b>	<b>Braking Systems</b>	<b>Transport Systems</b>	<b>Reprographics</b>
<b>Refrigeration Systems</b>	<b>Energy Storage</b>	<b>Nano-Technology</b>	<b>Energy Drivers</b>

# Section 3.0

## Applications That May Impact Tomorrow's Magnet Demand

- **Hybrid Automobiles**
- **Electric Automobiles**
- **Wind Turbines**
- **Industrial Motors**
- **Appliance & HVAC Motors**
- **Energy Storage Systems**
- **Magnetic Refrigeration**
- **Magnetic Levitation Transportation**

# **Section 4.0**

## **China's Future in the Global Magnet Industry**

- **Detailed Production Statistics**
- **Production 2010-2020 Forecast (\$'s & Tons)**
  - **Sintered Ferrite**
  - **Bonded Ferrite**
  - **Sintered NdFeB**
  - **Bonded NdFeB**
  - **Samarium Cobalt**
  - **Alnico**
- **The Government's Rare Earth Strategy**

# Section 4.0

## China's Future in the Global Magnet Industry

- **The Chinese Government's Rare Earth Strategy:**
  - **Gradually address environmental and safety concerns (expensive and lengthy)**
  - **Limit exports of REO's to satisfy domestic needs (local economy growing at 10%/yr)**
  - **Emphasize export of value added products (like magnets)**

# Section 5.0

## Major Industry Patents

- **Ferrite - Lanthanum Compositions**
- **Samarium Cobalt- High Temp Compositions**
- **NdFeB**
  - Hitachi (Neomax)
  - Magnequench (Neo Materials)

# **Section 6.0**

## **Raw Material Issues**

- **Supply, Demand & Price Issues**
  - **Iron Oxide** – China increasing production
  - **Cobalt** – Future price spikes likely
  - **RE Oxides** – Currently **THE HOT ISSUE**
- **30 Pages**

# **Section 6.0**

## **Rare Earth Prices Have Been Volatile**

- **Recovering Market Demand**
- **Chinese Export Restrictions**
- **Increasing Export Taxes**
- **Consumer Stockpiling**
- **Speculation**

# **Section 6.0**

## **Assessment of Potential Western REO Sources**

- Company Description**
- Resource Assessment**
- Strengths**
- Weaknesses**
- Opportunities**
- Threats**



# Section 6.0

## Assessment of Future REO Sources

<b>Alkane Resources</b>	<b>Greenland Mineral &amp; Energy</b>
<b>Arafura Resources</b>	<b>Lynas Corporation</b>
<b>Avalon Rare Metals</b>	<b>Molycorp Minerals</b>
<b>Baotou Iron &amp; Steel</b>	<b>Rare Element Resources Ltd.</b>
<b>Great Western Minerals Group</b>	<b>U.S. Rare Earths</b>

# **Section 6.0**

## **Raw Material Outlook**

- **China will gradually develop independency regarding Iron Oxide**
- **Cobalt prices will fluctuate but no future crisis is expected**
- **China's REO dominance will gradually decline as Western production slowly ramps up**

# Section 7.0

## Human Resource Issues

- **The decline of Western engineering talent**
- **Increasing numbers of Magneticians are being educated in China and India**
- **USA universities are educating many foreign students who are now returning to their homelands**
- **In-house training and development is the most attractive option for the West.**

# **Section 8.0**

## **University Research Initiatives**

- **Program Overview & Description**
- **Major Capabilities**
- **Key Personnel**
- **Current Research Interests**
- **Recent Publications**

# **Section 8.0**

## **University Research Initiatives**

- **Ames Laboratory (Iowa State)**
- **University of Birmingham**
- **University of Dayton**
- **University of Delaware**
- **IFW Dresden**
- **National Institute of Minerals Science**
- **Northeastern University**
- **Southwest Institute of Applied Magnetism of China**
- **University of Texas at Arlington**
- **Trinity College (University of Dublin)**
- **Technical University Wien (Vienna)**

# **Section 9.0**

## **Magnet Industry Associations**

- **China Magnetic Materials Device Association**
- **IEEE Magnetics Society**
- **The Japan Association of Bonded Magnetic Materials**
- **SMMA – The Motor and Motion Association (PMD)**
- **UK Magnetics Society**
- **United States Magnetic Materials Association**

# Section 10.0

## Permanent Magnet Company Directory

- **500+ Companies**
- **Segmented into Three Geographic Regions**
  - **Asia-Pacific (76%)**
  - **Europe & The Middle East (15%)**
  - **The Americas (9%)**
- **Manufacturers, Distributors and Fabricators**
- **Qualitative/Subjective Ranking System**
- **Brief Description of Each Company**

# Section 10.0

## Permanent Magnet Company Directory (Top 85%)

- **China (including Hong Kong) – 261 (53%)**
- **USA – 85 (17%)**
- **India – 31 (6%)**
- **UK – 18 (4%)**
- **Germany – 17 (3%)**
- **Japan – 11 (2%)**



# Section 10.0

## Permanent Magnet Company Directory (Other 15%)

- **Australia – 6 (1%)**
- **Switzerland – 6 (1%)**
- **France – 5 (1%)**
- **Italy – 5 (1%)**
- **All Others - 56 (11%)**

# **Section 10.0**

## **Company Directory**

### **Qualitative Company Ratings**

- Subjective approach based on:**
  - Sales Volume**
  - Geographic Scope**
  - Product Breadth**
  - Technical Capability**
  - Industry Reputation**
  - Authors' Experience**

# Section 10.0

## Company Directory

### Qualitative Company Ratings

	<b>#1</b>	<b>#2</b>	<b>#3</b>	<b>NR</b>
<b>North and South America</b>	<b>5</b>	<b>3</b>	<b>7</b>	<b>81</b>
<b>Europe &amp; Middle East</b>	<b>2</b>	<b>5</b>	<b>14</b>	<b>54</b>
<b>Asia and Australia</b>	<b>8</b>	<b>11</b>	<b>47</b>	<b>264</b>
<b>Total</b>	<b>15</b>	<b>19</b>	<b>68</b>	<b>399</b>

# Section 11.0

## Directory of Powder Producers

	<b>Ferrite</b>	<b>NdFeB</b>	<b>Alnico</b>
<b>China</b>	<b>15</b>	<b>7</b>	<b>4</b>
<b>USA</b>	<b>3</b>	<b>-</b>	<b>-</b>
<b>Brazil</b>	<b>3</b>	<b>-</b>	<b>-</b>
<b>Japan</b>	<b>1</b>	<b>1</b>	<b>-</b>
<b>Switzerland</b>	<b>1</b>	<b>1</b>	<b>-</b>
<b>Italy</b>	<b>1</b>	<b>-</b>	<b>-</b>
<b>India</b>	<b>1</b>	<b>-</b>	<b>-</b>

# **Section 12.0**

## **Directory of Industry Service Providers**

- **Instrumentation and Measurement Equipment (46)**
- **Software for Magnetic Circuit Design (18)**
- **Industry Consultants (53)**
- **Magnetics Industry Publications (7)**

# Section 13.0

## Appendices

- **Permanent Magnet Basics**
- **Magnetic Materials in Automotive Systems**
- **The Development of China's Rare Earth Magnet Industry**
- **Neomax Patent & License Status**
- **Magnequench Patent Information Guide**
- **China's Rare Earth Industry: What can the West learn?**
- **What Rare Earth Crisis?**
- **Rare Materials – How Scarce are They?**

**Thanks to so many.....**

**The authors are grateful to the many individuals, companies and organizations, worldwide, who contributed to this initiative.**

**Many offered valued input and challenged us to consider a variety of opinions. Their contribution was very much appreciated.**

# SUMMARY

- **This book is a unique resource for anyone involved or interested in the global permanent magnet industry**



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- This book is a unique resource for anyone involved or interested in the global permanent magnet industry
- **Major topics (each accounting for more than 10% of total content) include:**
  - **Industry Statistics and Applications**
  - **China**
  - **Rare Earth Raw Materials**
  - **Industry Directories**
  - **Automotive Applications**

# Who Should Find Value

- ***Those Seeking an Improved Strategic Planning Process for Their Business***

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- *Those Seeking an Improved Strategic Planning Process for Their Business*
- *Companies Researching Acquisition, Investment or Divestment Opportunities*
- *Improving your overall “Magnet IQ”*
- ***Establishing or Assuring a Reliable Magnet Supply Chain***

# Who Should Find Value

- *Those Seeking an Improved Strategic Planning Process for Their Business*
- *Companies Researching Acquisition, Investment or Divestment Opportunities*
- *Improving your overall “Magnet IQ”*
- *Establishing or Assuring a Reliable Magnet Supply Chain*
- ***Those Supplying Goods and Services to the Magnet Industry***

# Book Ordering Information

- **“Permanent Magnets 2010-2020” can be purchased from a number of sources:**
  - **MagneticsMagazine.com**
  - **SpontaneousMaterials.com**
  - **Terramagnetica.com**
  - **WaltBenecki.com**
  - **WebMagnetics.com**

# *Thank You!*

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