

Rare Earth Supply Chain[†]

Oxides (current and under construction)	Metals, Alloys, & Powders	Magnets	
Lynas <i>Australia / Malaysia</i>	Great Western Technologies Inc. / Less Common Metals <i>US/ UK</i>	Samarium Cobalt Manufacturers*	Samarium Cobalt Distributors/ Fabricators**
Molycorp "Resources" <i>US – ~H1 2013³</i>	Molycorp "Magnetic Materials & Alloys" <i>US (formerly Santoku Corporation)</i>	Electron Energy Corporation <i>US</i>	Integrated Magnetics <i>US</i>
Great Western Minerals Group <i>South Africa – ~3 years after ReCl Production</i>	Shin Etsu <i>China & Japan</i>	Arnold Magnetic Technologies <i>US/ Switzerland</i>	Dexter Magnetic Technologies <i>US, UK, China</i>
Japan Oil, Gas & Metals Nat. Corp. (via industry cooperation in Canada, Kazakhstan, Malawi, and elsewhere) <i>Japan</i>	Molycorp "Magnetic Materials & Alloys" <i>China / Thailand (formerly Neo Materials)</i>	Zhejiang Tinnau Group <i>China</i>	Quadrant <i>US</i>
Molycorp "Chemicals & Oxides" (Sillamäe) <i>Estonia</i>	Sinosteel <i>China</i>	Ningbo Co-Star Material High Tech Co. Ltd <i>China</i>	Magnetic Component Engineering, Inc. <i>US</i>
China produces ~90% of world supply[†] (Top 7 2013 Export Quota Allocations)	Zhe Jiang Zhao-Ri-Ke Magnet Industries (NdFeB powders) <i>China</i>	Nanjing Chuangken Magnetism Co. Ltd <i>China</i>	Bunting <i>US</i>
Baotou Steel Rare Earth Hi-Tech <i>China</i> (3,358 tonnes LRE & 208 tonnes M/HRE)	Goring Rare Earth Corporation Ltd. <i>China</i>	Ningbo Ninggang Perm. Magnetic Materials Co. Ltd. <i>China</i>	Adams <i>US</i>
Baotou Rhodia Rare Earth Co. & Liyang Rhodia Rare Earth New Materials <i>China</i> (3,042 tonnes LRE & 425 tonnes M/HRE)	Jiangxi Rare Earth and Rare Metals Tungsten Group Corp. <i>China</i>	Chengdu Magnetic Material Science & Technology Company <i>China</i>	Magnet Sales <i>US</i>
Molycorp "Chemicals & Oxides" (JAMR & ZAMR) <i>China</i> (2,416 tonnes LRE & 300 tonnes M/HRE)	Aichi Steel Corporation (NdFeB powders) <i>Japan</i>	Xichang Magnet Industry Co. <i>China</i>	Stanford Magnetics <i>US</i>
China Minmetals <i>China</i> (1,658 tonnes LRE & 378 tonnes M/HRE)	Showa Denko K.K. <i>Japan / China / Vietnam</i>	Ningbo Strong Magnet <i>China</i>	Dure Magnetic <i>US</i>
Gansu Rare Earth New Materials Co. <i>China</i> (1,695 tonnes LRE & 160 tonnes M/HRE)	Sumitomo <i>Japan</i>	Fellermagnets <i>China</i>	Applied Magnets <i>US</i>
China Nonferrous Import-Export Co. (Jiangsu) <i>China</i> (1,534 tonnes LRE & 303 tonnes M/HRE)	Toyota Tsusho Corporation <i>Japan</i>	Shin Etsu (Shin Etsu-Rare Earth Magnets) <i>China & Japan</i>	Ningbo Lihe Permanent Magnetic Materials <i>China</i>
Griem Advanced Materials Co. <i>China</i> (1,457 tonnes LRE & 299 tonnes M/HRE)	Sojitz Corporation (Santoku Corporation) <i>Japan</i>	Sumitomo Special Metals Corp. <i>Japan</i>	Ningbo Xionghai Magnetics & Mechanism Industrial Co. Ltd. <i>China</i>

***Manufacturers** typically create their own proprietary alloys, and either cast or sinter magnets from those alloys. Control over the quality of the alloys is an important distinction of this group, as they are not typically dependent on overseas material suppliers. In addition to cast and sintering capabilities, the magnet manufacturers also typically utilize heat treating processes, in order to further enhance the properties of the magnets. The magnet manufacturers generally maintain a full range of manufacturing capabilities, to enable them to manufacture all forms of custom designs and applications. Magnet manufacturers can also fabricate high value components utilizing the magnets they have made.

****Distributor/Fabricators** typically import overseas material and resell it to domestic customers. Many merely pass product through from manufacturers to end-users. Others do some minimal grinding. The more sophisticated of the lot will fabricate higher value components using imported magnets. These companies also often work with various non-rare earth magnets including AlNiCo, Ferrite, and others.

¹ Began NdFeB production in May 2013
² Past manufacturer of Neodymium Magnets (NdFeB)
³ Expected date reflects Project Phoenix phase 1 completion date
⁴ Signed a joint venture agreement to manufacture Neodymium Magnets (NdFeB) in 2013
⁵ Collectively owned by One Equity Partners, an affiliate of JPMorgan Chase & Co.
 † Examples, not an inclusive list
 † To our knowledge, export quota data has not been revised, but the rare earth industry in China is drifting towards a consolidation into five major rare earth producers based in the following major provinces: Baotou Steel Rare Earth Hi-Tech (Inner Mongolia), Aluminum Corporation of China "Chalco" (Jiangsu), Rising Nonferrous Metals Share (Guangdong), Ganzhou Rare Earth Group (Ganzhou), and China Minmetals Corporation (Guangdong, Jiangxi, Guangxi, Hunan).
 † Licensed or authorized by Hitachi Metals to manufacture & sell sintered NdFeB magnets world-wide, except Japan
 ★ Licensed to manufacture by Hitachi Metals to manufacture & sell sintered NdFeB magnets world-wide, with limited rights to manufacture, sell and ship to or within China
 ✓ Licensed to manufacture & sell sintered NdFeB magnets under older Hitachi Metals patents

TDK <i>Japan</i>	Compass Magnets & Components <i>China</i>
Vacuumschmelze GmbH/ Neorem <i>Germany/ Finland</i>	Neodymium Iron Boron Distributors/ Fabricators**
Neodymium Iron Boron Manufacturers*	Dexter Magnetic Technologies <i>US, UK, China</i>
Hitachi Metals ¹ <i>Japan/US</i>	ForceField <i>US</i>
Thomas and Skinner ² <i>US</i>	KJ Magnetics <i>US</i>
TDK ★ <i>Japan</i>	Allstar Magnetics <i>US</i>
Daido Steel <i>Japan</i>	Quadrant <i>US</i>
Shin Etsu ★ <i>Japan</i>	Adams <i>US</i>
Daido Steel, Mitsubishi, Molycorp ⁴ <i>Japan</i>	Bunting Magnetics <i>US</i>
Vacuumschmelze GmbH ✓ / Neorem ✓ / Morgan Crucible ⁵ † <i>Germany/ Finland / UK</i>	Magnetic Component Engineering, Inc. <i>US</i>
Magnetfabrik Schamberg ✓ <i>Germany</i>	Magnet Sales <i>US</i>
Advanced Technology & Materials Co., Ltd. † <i>China</i>	Stanford Magnetics <i>US</i>
Anhui Earth-Panda Advance Material Co., Ltd. † <i>China</i>	Dure Magnetics <i>US</i>
Beijing Jingci Magnetism Technology Co. † <i>China</i>	Integrated Magnetics <i>US</i>
Beijing Zhong Ke San Huan High-Tech Co., Ltd. † <i>China</i>	Viona Corporation <i>US</i>
Ningbo Jinji Strong Magnetic Material Co., Ltd. † <i>China</i>	Ningbo Lihe Permanent Magnetic Materials <i>China</i>
Ningbo Yunsheng Co., Ltd. † <i>China</i>	Ningbo Xionghai Magnetics & Mechanism Industrial Co. Ltd. <i>China</i>
Thinova Magnet Co., Ltd. † <i>China</i>	Compass Magnets & Components <i>China</i>
Yantai Zhenghai Magnetic Material Co., Ltd. † <i>China</i>	
Zhejiang Tinnau Group <i>China</i>	
Ningbo Co-Star Material High Tech Co. Ltd <i>China</i>	
Nanjing Chuangken Magnetism Co. Ltd <i>China</i>	
Ningbo Konit Industries Inc. Ltd. <i>China</i>	
San Huan New Material High-Tech Inc. <i>China</i>	
Tianjin San Huan Lucky New Materials Inc. Ltd. <i>China</i>	
SANVAC Magnetics Co., Ltd. <i>China</i>	
Zhaoqing San Huan Jingyue Magnetic Materials Inc. Ltd. <i>China</i>	
Baotou Yunsheng Strong Magnet Material Co. Ltd. <i>China</i>	
Ningbo Yunsheng Strong Magnet Material Co., Ltd. <i>China</i>	
Baotou Showa Rare Earth High-Tech new Material Co. Ltd. <i>China</i>	
Beijing Sanjili Rare Earth Co. Ltd. <i>China</i>	
Constant Magnetic Materials Technology Group Co., Ltd. <i>China</i>	
Ningbo Ninggang Perm. Magnetic Materials Co. Ltd. <i>China</i>	
Beijing San Huan new Material High-Tech. Inc. <i>China</i>	
Ganzhou Huajing Rare Earth New Material Co., Ltd. <i>China</i>	
Ganzhou Dongci Rare Earth Co., Ltd. <i>China</i>	
Ningbo Zhongshi <i>China</i>	
Shenzhen Shengli Magnetic Products Co, Ltd. <i>China</i>	
Fellermagnets <i>China</i>	
Taiyuan Gangyu <i>China</i>	
Shougang Company <i>China</i>	
Penyes (HK) Ltd. <i>China (Hong Kong)</i>	
Shenzhen Aoke Mining Industry <i>China</i>	
Shanxi Gaoke Magnetolectric Co. Ltd. <i>China</i>	