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RESEARCH SUMMARY

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Rare Metal Demand Forecast: Key Findings 2010

- Driven by next generation automobiles and electronic products, the market will expand by 1.5 times in 2020 compared to 2009-

◆ Research Outline

Yano Research Institute has conducted a study on the rare metal demand forecast as described below.

1. Research period: October 2009 to March 2010
2. Research targets: Rare metals used in automobile, key energy-saving and electronics products, manufacturers of these products
3. Research methodologies:
   Face-to-face interviews with relevant personnel, supplemented by interviews via telephone and e-mail, and literature researches.

< Domestic demand of rare metals >

Rare metals are the scarce non-ferrous metals, production and industrial use of which is limited due to the limited reserves and eccentric locations, high cost of mining and refinery and so forth. Generally speaking, the rare metals are defined to include 47 elements of 31 mineral species. In this research, rare metals used in 3 major industrial sectors, automobile, key energy-saving and electronic products are selected and reviewed for providing the domestic demand forecast including exports.

◆ Key Findings

- **Domestic rare metal demand in 2009 was 198.7 K ton, about 90 percent of which is for automotive industry**
  The demand of rare metals in 2009 for the 3 demand segments being reviewed in this research, automobiles, key energy-saving and electronics products was 198,800 tons, being comprised of 88.4 percent for automobiles, 7.8 percent for key energy-saving products and 2.9 percent for key electronics products.

- **Domestic rare metal demand in 2020 is estimated to be 295,400 tons, which is about 1.5 times of the demand in 2009**
  The domestic rare metal demand is expected to grow considerably to 272,200 tons in 2015 and to 295,400 tons in 2020, about 1.5 times of the demand in 2009.

- **Next-generation automobiles and "energy-saving" products will increase the demand of rare metals.**
  About 90 percent of the domestic demand of rare metals in 2009 was made up of 5 spices of rare metals, Chromium (Cr), Manganese (Mn), Nickel (Ni), Magnesium (Mg), and Cobalt (Co). From now on, "energy-saving" products will increase the demand of rare metals, which include next-generation automobile (lithium-ion battery, motor, etc), LED, solar cell, fuel cell and wind-power generation. Especially fast demand-growing rare metals are Nickel (Ni), Tungsten (W), Cobalt (Co), Vanadium (V), Magnesium (Mg), Lithium (Li), Palladium (Pd), Rhodium (Rh), Neodymium (Nd), Dysprosium (Dy), and Indium (In), and the activities on the stable supply of these rare metals are becoming important

◆ Report format:

Published report: "Prospects of Rare Metals Toward 2020"
Issued in: June 2010
Language: Japanese
Format: 304 pages in A4 format
Price: 12,000 yen (600 yen of consumption tax shall be charged for the sales in Japan.)

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◆ Research Summary

1. Environment surrounding rare metals, and the prospects for 2020

Due to the limited reserves and eccentric geographical locations, rare metal could be an issue of resource nationalism, and "depletion" of resources has become a matter of global concern. With these concerns of the industry, future trends in the demand of rare metals are attracting attentions as they are used in the next-generation automobiles such as hybrid electric vehicle and electric vehicle, key energy saving products, and components of key electrics products.

The demand of rare metals in three demand sectors being reviewed in this research, automobile, key energy-saving and electronics products, in 2009 was 198,800 tons, and expected to increase considerably to 272,200 tons in 2015 and to 295,400 tons in 2020, reaching to 1.5 times of the demand in 2009. The composition of the market by demand sector in 2009 was 88.4 percent for automobile, 8.7 percent for energy-saving products and 2.9 percent for electronics products, the automobile being accountable for about 90 percent of the total demand. This market composition is expected to remain until 2020 without any major changes.

As to the mineral species, about 90 percent of the total demand in 2009 was made up of 5 mineral species consisting of Chromium (Cr), Manganese (Mn), Nickel (Ni), Magnesium (Mg), and Cobalt (Co).

It is expected that the demand will increase for many mineral species from now on, especially driven by energy-saving products including next-generation automobile (lithium-ion battery, motor, etc.), LED, solar cell, fuel cell, wind-power generation and so forth.

As to mineral species, greater growth of demand is expected for Nickel (Ni), Tungsten (W), Cobalt (Co), Vanadium (V), Magnesium (Mg), Lithium (Li), Palladium (Pd), Rhodium (Rh), Neodymium (Nd), Dysprosium (Dy), and Indium (In). And, therefore, activities on the stable supply of these rare metals will become important from now on.

2. Trends by major demand sector

2-1. Automotive industry: Gasoline/Diesel engine vehicles, next-generation vehicles (HEV/PHEV*/EV)

As to the automotive industry, existing automobiles such as gasoline and diesel engine powered vehicles on which a good deal of rare metals are being used, as well as the next generation vehicles including auto parts, molds and tools are reviewed in this report. The demand of rare metals in this sector is focused on the additives for alloy metals. Chromium (Cr), Manganese (Mn), and Nickel (Ni), indispensable for standard and special steels, especially, account for the major portion of demand. Also, platinum group used in three-way catalyst and oxygen sensor will remain important although the volume is limited. In the meantime, the demand of Neodymium (Nd), Dysprosium (Dy), and Lithium (Li) for the use in next-generation vehicles appears to be in an increasing trend.

(*: Plug-in hybrid vehicle)

2-2. Key energy-saving products: Solar cell, lithium-ion battery, LED, fuel cell, wind power generation

As to the key energy-saving products, solar cell, lithium-ion battery, LED, fuel cell and wind power generation are reviewed in this research. The rare metal demand in 2009 was centered on the lithium-ion battery. Especially, Co, Mn, and Ni used in the positive electrode materials account for the major portion of demand. Currently, as Japanese positive electrode material manufacturers have overwhelming shares in the global market, the domestic demand is increasing as well. From now on, the demand of rare metals is expected to increase along with the full-scale commercialization and expansion of the new products such as fuel cells, solar cells and LED.

2-3. Key electronics products: Mobile phone, digital camera, PC, TV, washing machine, refrigerator, air conditioner

As to the electronics products, mobile phone, PC, DSC, TV, washing machine, refrigerator, and air conditioner are reviewed in this research. A great number of rare metals are being used in electronics products, ranging from Co which is used in large quantity to those used as additives in very small

quantity for controlling the part quality and performance.

The demand of rare metals for this sector in 2009 was centered on the capacitors, plating, battery, motor and HDD used for mobile phone, digital camera, PC, TV, washing machine, refrigerator and air conditioner. In the future, while the demand of Ni will increase centered on capacitors, the demand of Indium (In) which is used for transparent electrode material is likely to increase more than ever, as applications such as touch panel or e-book will become popular. Since 2002−2003, "indium depletion issue" has been pointed out. As a possibility of running into indium shortage is undeniable, there are nation-wide activities on the material composition change to avoid using indium, reduction of indium use volume by reducing the thickness of indium layer, and the development of alternative materials.

Table 1: Domestic Rare Metal Demand Forecast by Demand Sector

(Unit: 1000t, %)

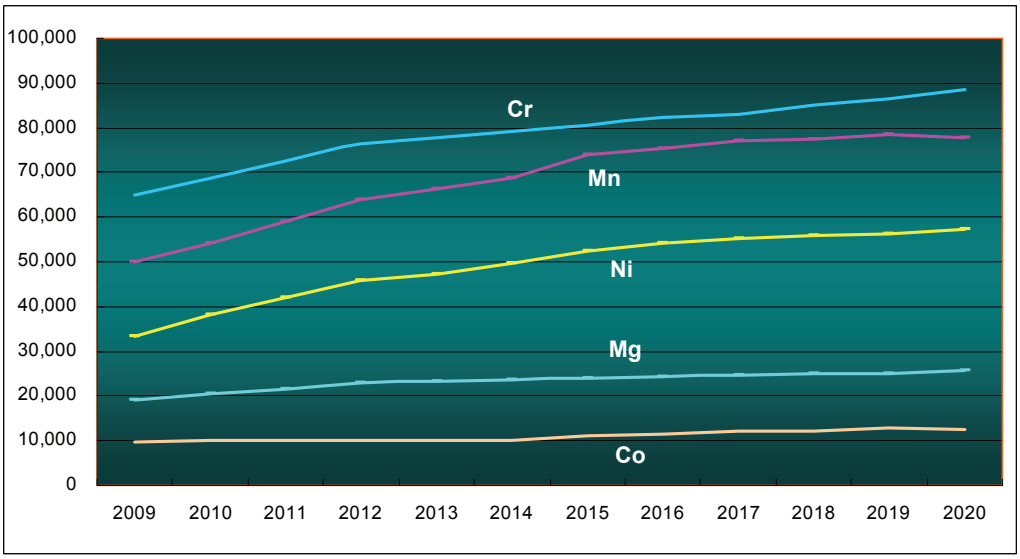
		2009	2015	2020
Automobile industry [Auto parts, molds, tools]		175.8	243.3	265.9
	Growth rate	100.0	138.4	151.3
Key energy-saving products [Solar cell, LIB, LED, fuel cell, wind-power generation]		17.2	21.3	21.2
	Growth rate	100.0	123.8	123.3
Key electronics products [Mobile phone, PC, TV, digital camera, washing machine, refrigerator, air conditioner]		5.8	7.6	8.3
	Growth rate	100.0	131.0	143.1
Total		198.8	272.2	295.4
	Growth rate	100.0	136.9	148.6

Estimated by Yano Research Institute

Note 1: Estimated based on the demand of target products in the demand sector
Note 2: Growth rate against 2009

Fig 1: Demand Forecast of Top 5 Rare Metals (Cr, Mn, Ni, Mg, Co) in Volume

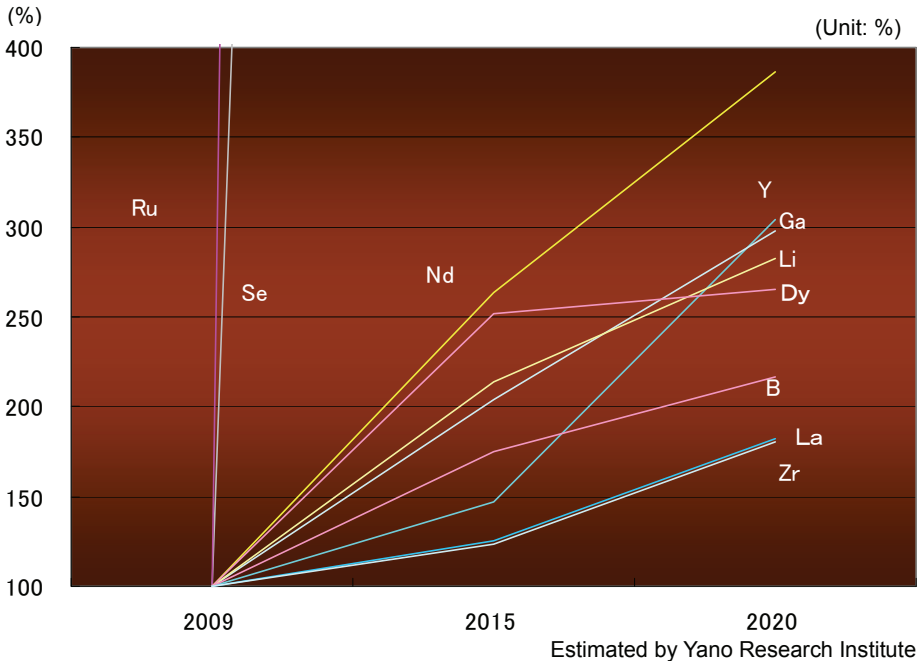
(Unit: tons)



Estimated by Yano Research Institute

Note 3: Top 5 rare metals in terms of the demand in volume based on the findings of this research

Fig 2: Top 10 High Growth Rate Rare Metals [2009 to 2020]



Note 4: Top 10 rare metals in terms of growth rate based on the findings of this research
Note 5: Growth rate against 2009