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Hitachi Develops Recycling Technologies for Rare Earth Metals

Developing machinery to separate and collect rare earth magnets from end-of-life products, extracting rare earths from rare earth magnets using a dry process

Tokyo, December 6, 2010 - - - Hitachi, Ltd. (NYSE:HIT / TSE:6501) today announced that it has developed technologies for recycling rare earth *[1] magnets from hard disk drive (HDD) motors and air conditioners *[2] and other compressors. Specifically, developed machinery to separate and collect rare earth magnets from end-of-life products, and successfully extracted rare earths from rare earth magnets using an experimental dry process. Going forward, Hitachi aims to commence full recycling operations by 2013 after calculating overall recycling costs and recovery ratio.

Separating and collecting rare earth magnets from HDDs manually requires approximately five minutes per worker per HDD (roughly 12 units per worker per hour). Hitachi has confirmed that the machinery it has developed is able to run the separation and collection with roughly eightfold increased efficiency (approximately 100 units per hour). In the case of compressors, the separation process was difficult thus far, but the development of new cutting machinery and demagnetizing machinery has made safe, efficient separation and collection possible.

The process of extracting rare earths from separated and collected rare earth magnets has been performed manually using acids and other chemicals, resulting liquid waste disposal that causes issues in terms of cost and environmental conservation. The new dry process, however, extracts rare earths using a special extraction material with high affinity for rare earths. Research is advancing toward the establishment of the dry extracting process that will reduce cost and environmental burden of extraction.

Rare earth magnets are alloyed metals consisting of roughly two thirds of iron and one thirds of rare earth metals, with neodymium added for a stronger magnetic force than the one in ordinary magnets, and dysprosium added to enhance heat resistance. These materials are essential in products that contribute to a low-carbon society such as HDDs used in personal computers and others, IT equipments, high-performance motors for IT factory automation, wind power generators, home appliances like air conditioners that excel in energy-saving performance and motors for hybrid cars. Meanwhile, approximately 97% of rare earth production volume comes from the People's Republic of China *[3], and given as a fact that developing alternative materials is time requiring matter, the recycling of rare earths from rare earth magnets in end-of-life products are expected to secure rare earths stably.

However, the process of separating and collecting rare earth magnets safely from products not only requires a great deal of time and effort but also chemicals for the process of extracting rare earths resulting liquid waste disposal which creates issues in terms of cost and environmental conservation.

Therefore, Hitachi has been developing rare earth recycling technologies that are safe, efficient, and environmentally conscious.

Hitachi was selected by Japan's Ministry of Economy, Trade and Industry to participate in its project to promote recycling of resources, launched in fiscal 2009. The project's goal is to find technology for recycling rare earth metals from "urban mines," such as high-performance magnets from motors, and Hitachi commenced its development in October 2009. Hitachi set up an outside advisory body, which operates under the guidance of experts including Kohmei Halada, managing director of the Center for Strategic Natural Resources of the National Institute for Materials Science, to facilitate this development. Details of the developed technologies are as follows.

(1) Development of machinery to separate and collect rare earth magnets from end-of-life products

Separate machinery was developed to separate and collect rare earth magnets from HDDs and compressors.

For HDDs, a drum-type unit spins to shake and prang the HDDs continuously, which loosens screws and disassembles the HDDs into their structural components (casing, disk, rare earth magnet component, etc.) *[4]. Because the components containing rare earth magnets emerge from the machinery separately, workers are able to pick out the desired components easily just by screening out visually.

For compressors, cutting machinery is first used to cut through the casing, and the rotors, which contain rare earth magnets, are manually exposed. Secondly, those rotors that contain rare earth magnets are disassembled with rotor ejecting machinery. Then, in order to safely collect the rare earth magnets, which have a strong magnetic force, device that generates a resonant current to weaken the magnetic field at room temperature *[5] reduces the magnet's magnetic force. Finally, a rare earth magnet remover causes a vibration to the rotor and only the rare earth magnets inside the rotor are separated and collected.

(2) Extraction of rare earths from separated and collected rare earth magnets

Through a joint work with Professor Toru H. Okabe of the University of Tokyo's Institute of Industrial Science, experiments of rare earth extraction technologies were conducted using a dry process rather than using acids and other chemicals, and neodymium and dysprosium were extracted from rare earth magnets.

This was achieved using special extraction material with high affinity for neodymium and dysprosium to separate rare earths and extraction material from the other non-rare-earth materials like iron in the rare earth magnet. Then the non-rare-earth materials are removed, heat is applied to distill the excess extraction material, and rare earths alloy remains.

Notes :

*1 : Rare earths refers to a group of 17 elements, consisting of the fifteen elements with atomic numbers 57 (La; lanthanum) through 71 (Lu ; lutetium), known as the lanthanoid series, and the atomic numbers 21 (scandium) and 39 (Y ; yttrium). Rare earth magnets are magnets that contain neodymium and dysprosium, which are included in this group.

*2 : Currently, rare earth magnets are used in some air conditioners that are collected as end-of-life products.

*3 : From the U.S. Geological Survey's "Mineral Commodity Summaries 2009."

*4 : Excluding some products that cannot be disassembled.

*5 : A resonant current is used to weaken the magnetic power by generating alternating forward and reverse currents (generating a magnetic field) in a magnetic coil to gradually reduce the magnetic field.

The Hitachi Group provides environmentally conscious products and services and strives to reduce the environmental burden of its business activities based on an Environmental Vision based on the three pillars of "prevention of global warming," "conservation of resources," and "preservation of ecosystem." The development of recycling technologies for rare earths is one step toward the "conservation of resources."

About Hitachi, Ltd.

Hitachi, Ltd. (NYSE: HIT / TSE: 6501), headquartered in Tokyo, Japan, is a leading global electronics company with approximately 360,000 employees worldwide. Fiscal 2009 (ended March 31, 2010) consolidated revenues totaled 8,968 billion yen ($96.4 billion). Hitachi will focus more than ever on the "Social Innovation Business," which includes information & telecommunication systems, power systems, environmental, industrial and transportation systems, and social and urban systems, as well as the sophisticated materials and key devices that support them. For more information on Hitachi, please visit the company's website at http://www.hitachi.com.

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