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KOKONOE ELECTRIC CO., LTD. Ritsumeikan University

"Rare Metal Substitute Materials Development Project - Development of Technologies to Reduce the Amount of Cerium Used for Precision Grinding and the Development of Substitute Materials" (FY2009-2012)

A Technology that Halves the Consumption of the Rare Earth Element that Is Indispensable for Glass Grinding



Rare earth elements are natural resources that are indispensable for producing technologically sophisticated products. Because they only occur in certain countries, there is a risk that the supply of them may be interrupted or decrease if a diplomatic problem or other unordinary situation arises.

Cerium, which is one of the rare earth elements, is a material that has been used in Japan for many years for glass surface grinding and other purposes. However, the sharp rises in the price of cerium in 2010 to 2011, during which the prices of other rare earth elements also surged, hurt the glass grinding industry. On the other hand, Ritsumeikan University and KOKONOE ELECTRIC CO.,LTD. which is a grinding tool manufacturer based in Kawasaki City of Kanagawa Prefecture, had formed a joint industry-academia team before this and participated in the "Development of Substitute Materials for Rare Metals" project of NEDO, endeavored to develop a technology to dramatically reduce the consumption of cerium in glass grinding under the project and succeeded in establishing that technology and commercializing a new grinding tool (grinding pads).

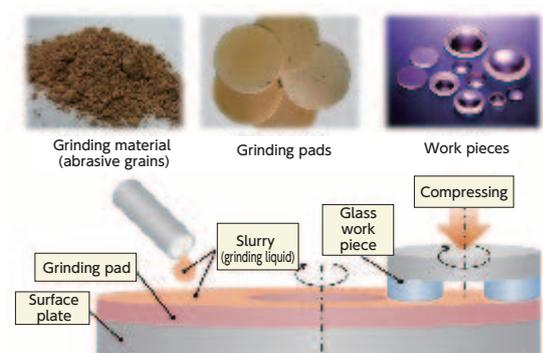
The newly developed grinding pad made it possible to reduce the consumption of cerium by one half. This grinding pad was commercialized in 2012, and was adopted by more than 10 companies in a little more than one year from the start of sale. It is expected that more companies will adopt the grinding pad in the future.



Grinding equipment with an epoxy pad attached



Grinding pads produced by KOKONOE ELECTRIC CO., LTD. - There are more than 10 epoxy pads that differ in thickness, hardness, density, etc. and more than 10 epoxy-urethane pads that differ in thickness, hardness and density, etc. The customer can choose the most suitable pad for the purpose from among these pads.



Glass grinding method - The grinding pad holds the grinding material (abrasive grains) and grinds the glass surface.



Large epoxy grinding pad with a diameter of 1200mm (Professor Tani (left) and Mr. Nomura, head of the development staff of KOKONOE ELECTRIC CO.,LTD. (right))

Q. Why did this project start?

Rare metals (rare earth elements) are raw materials for components with high added values that support Japan's industrial sector. In recent years, demands for rare metals have been increasing at rates that are faster than ever. However, there has been increasing concern since the second half of the 2000s that it may be difficult to secure a stable supply of rare metals in Japan in the mid- and long-term because of the increasing demands in developing countries, the scarcity of rare metals, the difficulty to replace them with other materials and the strong dependence on a limited number of rare metal producing countries. In June 2006, the Japanese government established the "Strategy for Securing a Stable Supply of Nonferrous Metal Resources," which was based on (1) promotion of mine development, (2) promotion of recycling, (3) development of substitute materials and (4) stockpiling. NEDO regularly conducted "Investigation of Risks Regarding the Supply of Rare Metals" from FY2006, and selected the target rare metals for the research and development taking into consideration the potential supply risks for each of the candidate rare metals and other factors. Cerium is one of the rare metals selected based on the results of the Supply Risk Investigation conducted in FY2008.

Q. What was the aim of the project?

This project aimed at reducing the consumption of rare metals including indium, dysprosium, tungsten, platinum, cerium, terbium, europium and yttrium and developing substitute materials for them. In particular, cerium (cerium oxide), which has been used for many years in Japan as a precision grinding material, is currently being used as a grinding material for the panel glass of flat panel displays (liquid crystal televisions etc.) and glass disks in hard disk drives for PCs, and other countries have been saying that Japan is the largest cerium consumer in the world. More than half of the cerium consumed in Japan is used as a grinding material. According to an estimate, the amount of cerium consumed in Japan in 2007 as a grinding material was 9000 tons (oxide equivalent). Because cerium only occurs in certain countries, there was concern that the supply of cerium in Japan may decrease as a result of future demand increases. Indeed the price of cerium surged in 2011, to approximately 16 times the price in 2010. Therefore, this project started research and development towards reducing the consumption of cerium oxide in precision grinding processes by 30% or more. Specifically, research and development for the development of new grinding technologies and of grinding pads that improve grinding characteristics was conducted based on the concept of "composite particle grinding technology" proposed by Professor Tani of Ritsumeikan University, with the objective of (a) developing a grinding material whose cerium oxide content is 30% or more lower than traditional grinding materials and which has grinding characteristics that are the same as or better than the grinding characteristics of traditional grinding materials and (b) developing a technology that achieves grinding efficiency improvement of 40% or more using the same amount of cerium oxide as traditional technologies.

Q. What is the role of NEDO?

Rare metals are indispensable resources for the production of sophisticated products, which is an area where Japan has an edge over many other countries. It is expected that demands for rare metals will continue to increase around the world in the areas of production of information technology-based home appliances, production of batteries and production of motors. For rare metals that are important for strengthening Japanese industries' international competitiveness, it is necessary to promote "the development of substitute technologies and consumption reduction technologies" and "efforts to put research results into practical use at an early stage." Such research and development is a national task for which a strong social need exists, but it involves very high development risks and requires advanced technological development. Therefore, it was necessary that NEDO should provide financial support and project management support for putting together multiple companies and research organizations, rather than relying on efforts of a single private-sector company or research organization.