August 2013

Sumitomo Electric Industries, Ltd.

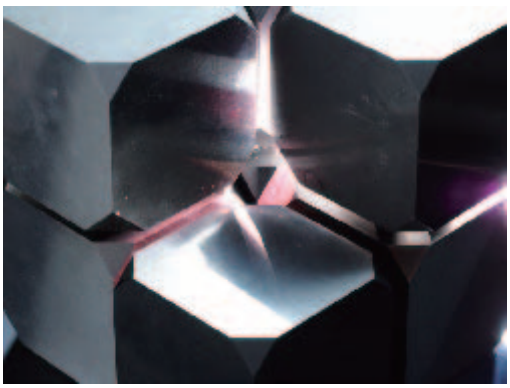
・Grant for Practical Application on Industrial Technology - Subsidized Project for Practical Development of Next-Generation Strategic Technology(FY2005-2006)

Renovation of “Cutting, grinding, and Polishing” Hardest and Strongest “Super Diamond”

Diamonds are often called “The King of Jewels” and have been loved as jewelry by people. They are also important for the manufacturing industry.

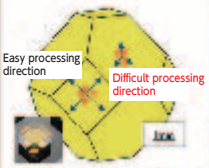
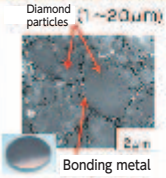
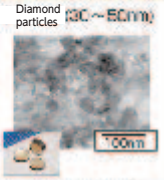
Artificial diamonds, first invented in the US in 1955, are now used for polishing and grinding hard materials. In the exponential progress of product manufacturing, technologies of processing finer and smaller materials and parts have become necessary. Also since materials to be processed have become diversified, harder, and more complex, material processing has become much more difficult. Therefore artificial diamonds are expected and requested to be harder and stronger in order to be used as tool materials.

Sumitomo Electric Industries, Ltd., the only mass-production company of artificial diamonds in Japan, succeeded in the mass production of the nano polycrystal diamond, which was twice as hard as ordinary ones, through an NEDO project. In 2011, it began to sell cutting tools with “Sumidia Binderless” and is almost reaching their goal of 1.2 billion yen in sales in 2014.



Inside the multi-anvil developed by Sumiya at Sumitomo Electric Industries, Ltd. for mass production of artificial diamonds

Cutting and polishing with ultra-hard alloy Sumidia Binderless

Material	Single crystal diamond (SCD)	Sintered diamond (PCD)*	Nano polycrystal diamond (NPD)
Structure or image			
Hardness (Knoop)	^80-120GPa (Orientation dependent)	^ 50-80 GPa	○ 110-130 GPa
Isotropy	× Large orientation dependence	○ Isotropic	○ Isotropic
Strength, defect resistance	× (111) Cleavage	○	○
Heat resistance (inert atmosphere)	○ 1600℃	× 600℃	○ 1600℃
Processing accuracy	○ <50nm	× 100-500nm	○ <50nm

Characteristics of nano polycrystal diamond (NPD) and comparison with ordinary ones

Q. Why did this project start?

In the severe international competition and the change of industrial structure, it is concerning that the performance of the research and development and that of the practical application of the research results, as well as technological renovation capability, is declining in Japan. For the establishment of a base of strong mid- and long-term economic development, it is necessary to activate the research and development performance of private companies, which constitute 80% or more of Japan's research and development investment. It has been pointed out that the improvement of Japan's innovation capability through the activation of the research and development of private companies and others is an important challenge. NEDO began to support private companies for their research and development in FY2000 and since then it has conducted "Subsidized project for practical development of industrial technology" to strengthen the international competitiveness, create new business and markets, and develop an active economic society.

Q. What was the aim of the project?

"Subsidized project for practical development of next-generation strategic technology," one of the projects in the category of "Subsidized project for practical development of industrial technology," is a system of supporting mid-term practical development that has a risk with insufficient company resources for research and development. No specific plan for commercialization of products is set up in this supporting system. But if the development is successful, achieved results would be widely utilized for products and services in the market and the technological progress would propagate to multiple new industrial fields. The supporting system has supported such commercialization research and development.

Q. What is the role of NEDO?

Using the technology development promotion committee or other committees with outside experts for interim evaluation, NEDO conducts project management and accelerates, shrinks or terminates projects of research and development themes, based on the technological trend and the policy trend as well as on the progress status of the research and development, in close relationship with the Ministry of Economy, Trade and Industry.