

# Highly conductive carbon nanotubes head to market

**JAPANESE COMPANIES, BOTH NEW AND OLD**, collaborate to take carbon nanotubes to an industrial scale.

**Stronger but lighter than steel**, carbon nanotubes are only a few billionths of a metre in diameter, but can be up to a thousandth of a metre in length. They have excellent electrical conductivity, but can also behave like a semiconductor. These attributes make them an exciting prospect for a wide variety of applications. But to realize these applications, and take them to the next level, requires an industrial-scale method to create high-quality nanotubes of controllable diameter and sufficient length. Meijo Nano Carbon and Osaka Soda, two Japanese companies with very different histories, are

now working together to meet this challenge.

Enhanced direct injection pyrolytic synthesis, or eDIPS, is one possible method of synthesizing carbon nanotubes. eDIPS originated at the National Institute of Advanced Industrial Science and Technology in Japan and this method is now being further developed by the venture company established in 2005, Meijo Nano Carbon. It differs from conventional methods in that it does not grow the nanotubes on a substrate, instead adopting a type of chemical vapour deposition that uses a fine metal catalyst floating in a flowing gas.

“By optimizing the reaction using two or more carbon sources with different decomposition properties, it is possible to synthesize high-crystal-quality, single-walled carbon nanotubes,” explains Takeshi Hashimoto, CEO of Meijo Nano Carbon. This approach has dual advantages — it creates nanotubes with a large electrical conductivity (a thousand times more conductive than carbon black) and it means that the distribution of nanotube diameters can be controlled.

**SUCCESS IS ALREADY DEMONSTRATED IN THE DIVERSITY OF THEIR CUSTOMERS**

Osaka Soda brings the expertise needed to take this process to an industrial scale. Established in 1915, Osaka Soda first produced caustic soda and chlorine gas by electrolysis of sodium chloride. Over the last century they have evolved into a company catering for the materials needs of the chemical, healthcare, biotechnology, energy and environmental business sectors. But bringing

their know-how to the fabrication of carbon nanotubes will take them back to their roots.

“Carbon nanotube production requires large amounts of hydrogen gas and we can readily supply pure hydrogen by the electrolysis of sodium chloride,” says Yoshiro Furukawa, director of Osaka Soda. “Therefore, we believe Osaka Soda can play an important role in scaling-up the production of carbon nanotubes to an industrial scale.”

The success of MEIJO eDIPS nanotubes is already demonstrated in the diversity of their customers: from chemical manufacturers of films and resins to aerospace- and automobile-related industries. And Hashimoto and Furukawa both agree that collaborations between venture and chemical companies are the ideal route to drive this success even further. ■



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Osaka Soda's new R&D facility serves as a base for collaboration



Carbon nanotubes made by the MEIJO eDIPS method



Transmission electron microscope image of MEIJO eDIPS nanotubes

