Mass production technology for single-wall carbon nanotubes
Returns the fruits of AIST's research in nanotechnology to society

We have transferred a seed technology of AIST, the Enhanced Direct Injection Pyrolytic Synthesis (eDIPS) method, for the manufacture of single-wall carbon nanotubes (SWCNTs), a cutting edge nanotechnology material, to Meijo Nano Carbon Co., Ltd. (MNC). We developed an industrial production plant through a collaborative project between the two parties, and verified the mass productivity of SWCNTs using the eDIPS method.

In the present study, various reaction conditions in the developed industrial production plant using the eDIPS method were optimized to attain a production speed 100 times that of the conventional high-quality carbon nanotubes (CNTs) manufactured and marketed by MNC. Based on this result, in 2014 MNC has become the first Japanese manufacturer to introduce SWCNTs synthesized by the chemical vapor disposition (CVD) method to the market. This will enable high-quality, high-purity samples to be placed in mass quantity on the R&D-use market and is expected to accelerate studies for commercial use of SWCNTs.

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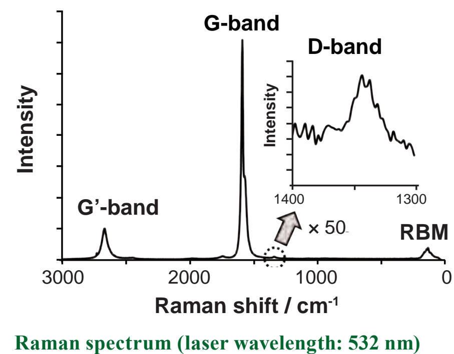
A lump of SWCNTs synthesized in the developed industrial production plant (compared to a smartphone)



Raman spectrum (laser wavelength: 532 nm)

New X-ray non-destructive inspection for industry
Investigation for effectiveness of X-ray Talbot interferometry

We investigated the effectiveness of X-ray Talbot interferometry using a laboratory X-ray tube for industrial inspection of packaged devices. Because the devices contain various components, such as semiconductors, metals, ceramics, and resins, it is difficult to inspect them. In this study, the conventional absorption image showed heavy-elemental components such as metal wires and electrodes, but the image did not reveal the defects in the light-elemental components. On the other hand, the differential phase-contrast image obtained by this method showed voids in the encapsulant of an IC package. The scattering-contrast image showed some cracks in the ceramic insulator of the power module sample. In addition, this image showed the silicon plate surrounded by the encapsulant having the same X-ray absorption coefficient. These defects and components are invisible in the conventional industrial X-ray imaging. Thus this interferometry has good potential for industrial inspection of packaged devices.

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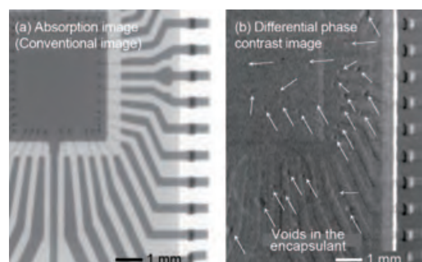
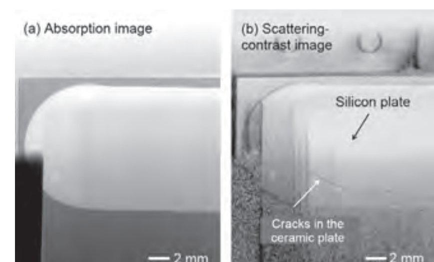


Experimental results for an IC package sample
(a) Absorption image (conventional image)
(b) Differential phase-contrast image



Experimental results for a power module sample
(a) Absorption image
(b) Scattering-contrast image