Modification of Carbon Nanotubes by Laser Ablation
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INTRODUCTION
Carbon nanotube (CNT)-metal composites are
attractive for applications such as nano-wiring and battery
electrodes. In this work, we deposited various types of
metal particles on the surfaces of CNTs by laser ablation,
and we investigated that the morphologies of the
deposited particles depended on the surface properties of
CNTs.

EXPERIMENTAL
A metal plate (10×10 mm²), such as copper and
aluminum, was set in a vacuum chamber as a laser
ablation target. A CNT film was set at the opposite to the
metal plate, which was prepared by dropping CNTs
dispersed in ethanol on a Si plate. We used “densest
carbon nanotubes (d-CNTs)”, which were produced by
RF plasma vaporization of graphite (1). We also used
“ragged carbon nanotubes (r-CNTs)” having a lot of
defects formed by irradiation of ultrasound (2). A pulsed
Nd:YAG laser (wavelength 266 nm, 10Hz) was irradiated
to the metal plate for 30 minutes in vacuum (4×10⁻¹¹ Torr)
or He gas (1-760 Torr). Ablated particles were deposited
on the CNT film. The produced CNT-metal composites
were characterized by scanning electron microscopy and
transmission electron microscopy.

RESULTS and DISCUSSION
Figure 1 shows the morphologies of the deposited
particles, when copper was used as a metal target in
vacuum. For as-grown CNTs (d-CNTs), large spherical
particles with diameters of about 400 nm were locally
deposited on the surface (Fig. 1(a)). On the other hand, r-
CNTs with many defects, which were formed via
ultrasonic irradiation for one hour, were uniformly
covered by thin metal layers (Fig 1(b)). Figure 2 shows
size distributions of Cu particles produced in He gas on
d-CNTs. As the pressure of He gas was increasing, the size
of Cu particles was increasing. These results suggest that
deposition of metal particles depend on surface property,
and the size of metal particles can be controlled by
adjusting gas pressure. In the case of r-CNTs TEM
observation revealed that copper nano particles were
deposited on the surface of r-CNTs (Fig. 3).

REFERENCES
2. A. Koshio, M. Yudasaka, M. Zhang, and S. Iijima,