Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Boron-catalyzed growth of multi-wall carbon nanotubes and their mechanical properties FUMIO KOKAI, TAKASHI OKADA, IORI NOZAKI, AKIRA KOSHIO, Mie University, TORU KUZUMAKI, Tokai University — Carbon nanotubes have received widespread interests in basic and applied research fields. However, many applications of carbon nanotubes are hindered by a lack of control of their precise morphology and microstructures. We report here an efficient synthesis of multi-wall carbon nanotubes (MWNTs) by laser vaporization in inert gas atmosphere. We used a continuous-wave Nd:YAG laser (600 kW peak power) to irradiate a graphite target containing boron carbide (boron content: 1-60 at.%) at room temperature. The pressure of He, Ne, or Ar gas was 0.05-0.90 MPa. The yield and morphology of MWNTs were strongly dependent on the inert gas type and pressure and the boron content. Ar provided higher yields and He led to lower yields. The maximum yield ($\sim$60%) of MWNTs was obtained for 20-30 at.% boron content and 0.1 MPa Ar gas. For He, Ne, and Ar, the outer diameters of the MWNTs were 4-40, 4-60, and 5-70 nm, and their lengths were up to 2, 5, and 30 μm, respectively. Young's moduli of MWNTs were also measured by nanoprobe manipulation in a TEM. The modulus was 680 GPa for a MWNT produced in 0.1 MPa Ar for 20 at.% boron content, which is much higher than those ($\sim$10 GPa) of MWNTs grown by CVD.

Fumio Kokai
Mie University

Date submitted: 09 Nov 2008 Electronic form version 1.4