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Uncatalyzed Etching of Single Walled Carbon Nanotubes on Surfaces SEAN PHEASANT, VALERIE MOORE, ROBERT HAUGE, RICHARD SMALLEY, Rice University — Aside from burning, the only way single walled carbon nanotubes (SWNTs) have been etched is with the use of a catalyst nanoparticle at high temperatures in an oxidative or reducing atmosphere. The catalyst is a particle close in size to the diameter of the nanotube, and is usually composed of iron, molybdenum, nickel or cobalt, or a combination of these metals. The catalyst operates at the ends of the SWNTs, where it dissociates molecules from the atmosphere on its surface, and combines them with carbon atoms from the tube to form a gas. It has been found that SWNTs can be oxidatively etched with CO2 at a high temperature (900C) in the absence of catalyst particles. The reverse of the Boudard reaction occurs at high temperatures to produce two molecules of CO from a molecule of CO2 and a C atom. When the ends of the tubes are closed, no etching is observed, indicating that only the open ends of the tubes can be attacked by CO2 and not the sidewalls. Experiments were done on both SiO2 and highly oriented pyrolytic graphite (HOPG). Results suggest the tubes etch faster on HOPG than they do on the oxide surface.

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