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SHAPING CARBON NANOTUBES WITH CHEMISTRY

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A single-walled carbon nanotube (SWNT) has a structure of a single sheet of graphite rolled to about 1 nm in diameter and length extending to over microns. Ever since its discovery in 1991, SWNTs have attracted attentions of physicists and engineers for their excellent physical properties that are promising for the development of nanotechnology. So far, all fundamental studies and applications have been focused on their native string-like form, simply because this is the only shape that the present synthetic methods afford. Here, we present examples of constructing various structures with SWNTs by applications of common organic reactions. These studies also help to gain deeper insight into physical properties of SWNTs in solution.

Ring-closure of SWNTs will be discussed to form **NANOTUBE RINGS**. Statistical analyses of the ring size distribution by modeling SWNTs to be worm-like polymer chains give a persistence length of SWNTs to be 0.8 μm. This means that SWNTs shorter than this length are stiff and straight, while those longer than the Kuhn statistical length of 1.6 μm undergo thermal fluctuation in solution. We then introduce yet another characteristic scale that is shorter than the persistence length. By fractionating SWNTs according to these characteristic sizes, chemical reactivity can be controlled. We demonstrate this idea by letting the ends of size-selected SWNTs react with amine-terminated dendrimer. This affords a formation of **NANOTUBE STARS** with dendrimers at the center.