

Fibres composed of [10]cycloparaphenylene and C₆₀

Takanobu Minakawa^a, Sieun Choi^b, Yuki Nagai^b, Utah Mashiko^b, Shunji Kurosu^c
and Toru Maekawa^{a,b,c}

^aDepartment of Biomedical Engineering, Toyo University

^bGraduate School of Interdisciplinary New Science, Toyo University

^cBio-Nano Electronics Research Centre, Toyo University

Cycloparaphenylene (CPP) is composed of several benzene ring (see Figure 1) [1]. CPP is a unit ring of carbon nanotubes (CNTs). C₆₀ is a cage composed of 60 carbon atoms (Figure 2) [2]. There are different types of CPPs depending on the number of benzene rings. In this study, we investigate secondary structures formed by CPPs and C₆₀ molecules. First, [10]CPPs and C₆₀ are individually dissolved in xylene and then two solutions are mixed at room temperature. Note that the ratio of the molar concentration of CPPs to that of C₆₀ is 1:1. The above mixed solution is dropped onto an Si substrate, the temperature of which is changed; 25, 30, 50 and 70 °C. The structures of nano materials produced in the solution are observed by a scanning electron microscope (SEM) (SU8030, Hitachi).

It is found that approximately 20 min after CPPs and C₆₀ molecules have been mixed, the fibres are formed in the solution. Notice that no structures are formed when CPPs and C₆₀ are individually dissolved in xylene. It is also found that fibres are deposited on the Si substrate when the temperature of the substrate is 25 °C, whereas the fibres are broken with an increase of the substrate temperature.

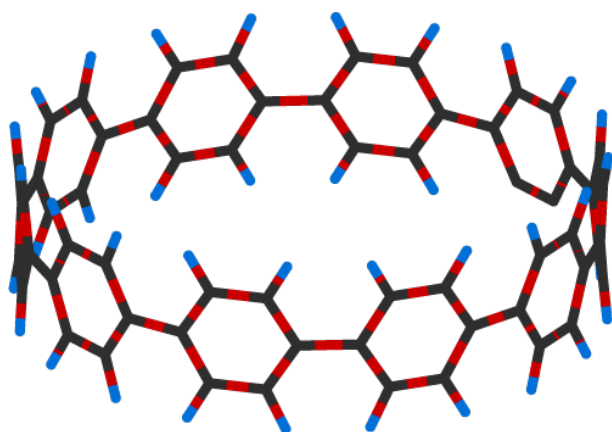


Figure 1. [10] Cycloparaphenylene.

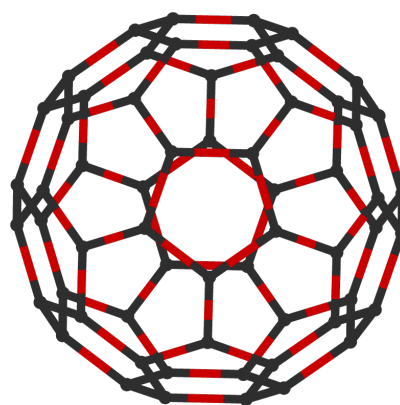


Figure 2. C₆₀ fullerene.

References:

- [1] Times New Roman, Character size 11pt, Line space 12pt. D. Li, M.B. Muller, S. Gilje, R.B. Kaner, G.G. Wallace, *Nat. Nanotechnol.* **3**, 101 (2008).
- [2] R.L.D. Whitby, A. Korobeinyk, S.V. Mikhalovsky, T. Fukuda and T. Maekawa, *J. Nanopart. Res.* **13**, 4829 (2011).
- [3] T. Iwamoto, Y. Watanabe, T. sadahiro, T. Haino and S. Yamago, Size-Selective Encapsulation of C₆₀ by [10] cycloparaphenylene: Formation of the Shortest Fullerene-Peapod, *Angew. Chem. Int. Ed.* **50**, 8342-8344(2011).