

26th April 2023

Proposal for appropriate geometric criteria and harmonized classification of MWC(N)T

For the sake of users and manufacturers of CNTs, JBCE would like to comment on the CLH report on multi-walled carbon tubes and multi-walled carbon nanotubes (MWC(N)Ts).

We would like to report an additional list of scientific papers on MWCNTs. The papers listed below are useful to understand the effects of CNTs *in vivo*, i.e., in living organisms. The knowledge so obtained is useful for the voluntary management system of CNTs. We hope that these would be helpful for your assessment.

● The classification of CNTs used in the CLH Report

The classification of CNTs used in the CLH report makes several assumptions in contrast with scientific data.

The CLH report advocates classifying all MWC(N)Ts having a diameter from 30 nm to 3 µm, with any length above 5 µm, and an aspect ratio above 3:1, as *presumed* or *suspected carcinogen*.

In addition, the CLH report claims that the toxicokinetic properties support an asbestos-like mode of action of rigid MWC(N)T fibers.

The following points require some corrections:

1. There is a lot of evidence showing that, in practice, MWC(N)Ts longer than 50 µm don't reach the alveoli of the lung.^{1,2}
2. There is no data supporting relocation for MWC(N)Ts with lengths above 50 µm and for diameters above 150nm.³ In addition, medical research has shown that very thin

¹ Y. Taquahashi, An improved dispersion method of multi-wall carbon nanotube for inhalation toxicity studies of experimental animals. *The Journal of Toxicological Sciences (J. Toxicol. Sci.)* Vol.38(4) (2013) 619-628.

² T. Kasai, et al., Development of a new multi-walled carbon nanotube (MWCNT) aerosol generation and exposure system and confirmation of suitability for generation and exposure system and confirmation of suitability for conducting a single-exposure inhalation study of MWCNT in rats. *Nanotoxicology*, March 8 (2) (2014) 169-178.

³ Nagai, et al., Diameter and rigidity of multi-walled carbon nanotubes are critical factors in mesothelial injury and carcinogenesis. *Proc. Natl. Acad. Sci. USA*, 108, E1330-1338 (2011).

(below 30 nm) as well as very thick (over 150nm) MWCNTs are less toxic.

3. The CLH report is based on the *fiber* paradigm. In 1997, the WHO called “fiber” all particles that can be observed using an optical microscope – that is, particles longer than 5 µm, with a diameter less than 3 µm, and with an aspect ratio larger than 3:1.

4. MWC(N)Ts are not biodegradable. However, a research group at AIST (a large research organization of the Japanese government) recently found out that MWC(N)T can be degraded by commercial chlorine bleach: MWC(N)T are oxidized to carbon dioxide by hypochlorite. This scientific finding is informative for drafting voluntary management procedures for MWC(N)T, especially for waste water and for working clothes. The possibility of degradation is a distinguishing characteristic of MWC(N)T that differs from asbestos.^{4,5}

5. Many MWC(N)Ts are not rigid and, many are not straight. In addition, thick MWC(N)Ts do not migrate as easily as thin MWC(N)Ts. This again distinguishes MWC(N)T from asbestos.

6. For thick CNTs, for long CNTs, for furballs, microcoils, nanocoils, nanohorns, nanobrushes and for many other types of MWC(N)Ts, there is no asbestos-like mode of action. Also, MWC(N)T chemistry is completely different from that of asbestos.⁶

7. MWC(N)T size properties are not uniform. The limit values should refer to average or to median values.

8. Most of the scientific literature uses average or D50 as size information to characterize MWC(N)T, and none of the scientific literature cited in CLH report express the MWC(N)T as “ideal substance”.

● JBCE Proposal

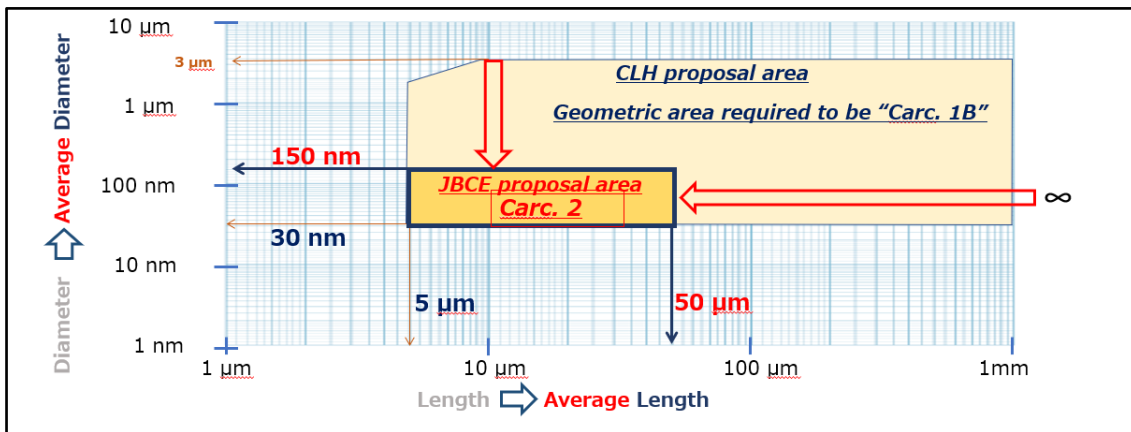
We would like to propose the following amendment:

- Multi-Walled Carbon Tubes (synthetic graphite in tubular shape) with a geometric tube **average** diameter range ≥ 30 nm to < 150 nm and an **average** length ≥ 5 µm to < 50 µm and **aspect ratio** $\geq 3:1$, MWNT-7 should be classified as suspected “Harmonized Classification: Carc. 2”.
- MWC(N)T other than MWNT-7 should be classified as “Harmonized Classification: Not Carcinogenic”.

⁴ M. Zhang, et. al., Diameter-Dependent Degradation of 11 Types of Carbon Nanotubes: Safety Implications. *ACS Appl. Nano Mater.* 2, 4293–4301 (2019).

⁵ Mey Yang, et al., Rapid room temperature degradation of carbon nanotubes by sodium hypochlorite and UV-light irradiation. *Carbon* 208 238–246 (2023)

⁶ Y. Wang, et. al., Role of hemoglobin and transferrin in multi-wall carbon nanotube-induced mesothelial injury and carcinogenesis. *Cancer Sci* 107(3) 250–257 (2016)



About JBCE

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