October 30, 2026

Expert Review Report

To: Dr. Tomohiro Hase, Advisor, IEEE History Committee
Subject: Discovery of Carbon Nanotubes for Electronics, 1991

I reviewed the plaque citation, the historical account, the discussion of related achievements, the supporting references, and the justification for including the name of Sumio Iijima, and I checked the key claims against the primary literature, including the 1991 and 1993 Nature papers. The discovery of carbon nanotubes is unquestionably an achievement of Milestone stature, and I recommend the proposal favorably. My answers to the seven questions are all affirmative. However, several points require correction or addition before the proposal is finalized so that it is fully accurate. None of them affects the merit of the achievement itself.

Disclosure of relationships: The reviewer has no co-authored publications with the proposers, and has no financial interest in the outcome of this proposal.

1. Is the suggested wording of the Plaque Citation accurate?
Yes. The citation correctly attributes the identification of multi-walled carbon nanotubes to Sumio Iijima of NEC Corporation in 1991, correctly connects the 1991 specimens to arc-discharge carbon produced at Meijo University, and appropriately describes the later development of nanotube electronics as a consequence rather than as part of the achievement. However, the phrase "in 1991 and 1993 using the arc-discharge method at Meijo University" should be confirmed. The 1991 specimens were prepared by Prof. Ando at Meijo University, as described in the Appendix. The reviewer could not confirm, however, that the 1993 single-walled nanotubes were also produced at Meijo University.

2. Is the evidence presented of sufficient substance and accuracy to support the Plaque Citation?
Yes. However, the following statement should be reconsidered for precision. The proposal states, in the section "Identification of a Previously Unknown Carbon Allotrope with a Well-Defined Nanoscale Geometry," that none of the previously known materials exhibited the tubular geometry. This is

contradicted by Section 6.1 (Oberlin and Endo, 1976) and by Radushkevich and Lukyanovich (1952), who published TEM images of hollow carbon filaments. Prof. Iijima's achievement is more precisely described as the discovery of the structure of this tubular carbon material (helicity determined by electron diffraction, concentric shells with 0.34 nm spacing, and the recognition of a new, well-defined form of carbon). It is clear that his structural discovery launched the field of carbon nanotube research and the electronics applications that followed.

3. Does the proposed milestone represent a significant technical achievement?

Yes. The 1991 paper is among the most highly cited papers in materials science (about 64,000 citations), and the discovery has been recognized by the Benjamin Franklin Medal in Physics (2002), the Balzan Prize (2007), the Kavli Prize in Nanoscience (2008), and many other honors. Carbon nanotubes opened the field of one-dimensional nanomaterials, provided the first material in which metallic or semiconducting behavior is determined by atomic-scale geometry, and became a central platform for nanoelectronics research. Many practical applications, such as batteries, have reached the market, contributing to the establishment of an energy-saving society. The significance criterion is met beyond any doubt.

4. Were there similar or competing achievements, and are they adequately described?

Yes. The proposal appropriately acknowledges Endo (1976), Abrahamson (1979/1999), and Tennent (1987) and correctly distinguishes structural identification from earlier observations of carbon fibres. The following items should be added to make the account complete: (1) Radushkevich and Lukyanovich, Zh. Fiz. Khim. 26, 88 (1952), earliest TEM images of hollow carbon nanofilaments, (2) Bethune et al., Nature 363, 605 (1993), independent discovery of single-walled nanotubes at IBM, published in the same issue as Prof. Iijima's paper. The reviewer considers that including this work is in fact favorable to the proposal, since Prof. Iijima's paper was received by Nature one month earlier than that of Bethune et al., which makes his priority clearer.

5. Have the proposers shown a clear benefit to humanity?

Yes. The benefit is real and substantial: carbon nanotubes are today manufactured in thousands of tons per year and are used as conductive additives in lithium-ion battery electrodes for electric vehicles, in composite materials, and in transparent conductors. In particular, the battery application of carbon nanotubes contributes significantly to improving the energy density, power, and lifetime of lithium-ion batteries, thereby contributing to the establishment of an energy-saving society. Further electronics applications such as flexible electronics, sensors, and carbon-nanotube transistors and processors are also under development.

6. Are the supporting reference texts credible? Are any missing?

Yes. However, the following corrections to the bibliography are needed.

[1] Iijima 1991 is Nature 354, 56-58, not 345.

[5] "P. M. Ajaya" should read Ajayan; "Ebbsen" should read Ebbesen.

[6] pages are 603-605, not "503-605".

[8] "Phys. Lev. Lett." should read Phys. Rev. Lett.

7. Has the proposer demonstrated that the criteria for name inclusion have been met?

Yes. The 1991 Nature paper is single-authored; the identification of the nanotube structure by HRTEM and electron diffraction was Prof. Iijima's individual scientific act; and the historical record, the literature, and the major international prizes consistently credit him.

Sincerely,

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