

Editorial

Abbreviate!

There is an expression in English, often applied to artistic performances, that describes things as “short and sweet”. A maxim of good scientific writing has always been to keep the manuscript “concise and precise”. The paper should be kept to a length consistent with the information it provides, and should contain enough detail to allow readers to repeat the experiment if they wish—the ultimate review.

Most papers I receive are far too long, particularly the Introduction. Why do most authors assume it necessary to provide a complete history of the subject? I recently returned a paper to an author with the comment that his paper started like a newspaper article and suggested that the first page could easily be replaced with a simple short sentence. Are there really any readers of papers on carbon nanotubes who need to be told of their initial discovery? Yet almost all papers on the subject start with a sentence such as: “Since their discovery by Iijima in 1991, carbon nanotubes have received increasing attention” The Editors sometimes want to scream when they read this! [Many people have pointed out that the statement is also not true, and that the sentence would be more accurate if written: “*In spite of the fact that carbon nanotubes have been known for decades, they have received much attention since 1991 because of the report by Iijima [1].*”] How many times have I had to remind authors that “references” are provided because the reader may need to “refer” to them. I imagine that most, if not all, readers never refer to papers cited in the first few paragraphs of the manuscript, because they contain the basic background that any interested person will already have. Yesterday I received a paper that spend the first few paragraphs describing the crystal structure, bonding, etc. of graphite. How unnecessary!

The problem of references is most severe in many Letters to the Editor, which have a length limit of five double-spaced pages of text, including references. It is unbelievable that an author will submit a Letter of which more than one page is introductory and two pages are references! There is only one page of new scientific content and the Editor is forced to think that publication is certainly premature. My suggestion to authors is that no more than ten references are necessary for a Letter.

Review articles are, of course different. They should provide a complete and updated history of the subject because they become a “reference” work on the subject. When a review article contains fewer than, say, 50 references, one wonders whether it really is a complete review of the subject, or whether it is too early for a review to be made?

One way we try to keep things short is to use abbreviations. These have come to pervade our language, in normal conversation as well as scientific writing. How many people will confess to having seen something “on the television” rather than “on TV”? Indeed, such English abbreviations often get carried over into other languages. Germans will often refer to TV even though the logical abbreviation for them would be “FS” (Fernsehen). The same is true of scientific conversation and writing. Nowadays we almost never say, “I am going to use the transmission electron microscope”. We refer to the instrument as the TEM (“tee ee em”) and the abbreviation has become part of understood speech among us. [Note that it is not an acronym, a much-misused term. If we call it a “tem”, to rhyme with “system” it becomes an acronym. An acronym is a word derived from the initial letters of several words.]

A major problem with abbreviations, especially for non-native English speakers, is when and how to use them. Here are some basic rules.

1. To define an abbreviation, first write the term in full followed by the abbreviation in parentheses. “X-ray diffraction (XRD) examination showed that the samples were not crystalline” Do not do the reverse.
2. Never define an abbreviation in the manuscript title. I was dismayed to see a paper in a recent issue of the journal with the title “Oxidative functionalization of carbon nanotubes in atmospheric pressure filamentary dielectric barrier discharge (APDBD).” The addition of “(APDBD)” to the title is unnecessary and makes it even more clumsy than it was to start with. I wonder what happened to the F?
3. Never use abbreviations in the Abstract without defining them, and only define them if they are used later *in the Abstract*. Remember that the Abstract must be able to

“stand alone”. An interested person may be able to download the Abstract from the Internet without cost, and it is the Abstract that then determines whether they will pay to download the whole paper. Abstracts are also published alone in some journals, such as Chem. Abstr.

4. Define an abbreviation the first time it is used in the text, even though it may also have been necessary to also define it in the Abstract.
5. Only define an abbreviation if you are going to use it later.

One recent paper spoke about “carbon nanotubes (CNTs) ... So far, so good. But the authors never used the abbreviation later. They continued to use the term “carbon nanotubes” and each time it was followed by “CNTs” in parentheses. Dare I say “stupid”!

Even with the above rules there are some problems associated with abbreviations. Is it always necessary to define them? How does one determine whether they are commonly understood? I remember a similar problem with using a capital (upper case) letter for an item such as a bunsen burner or a diesel engine. In fact, many of my students were unaware that these took their names from the family names of their inventors. Should we write “diesel engine” or “Diesel engine”? The advice given was that we use the capital letter while the person is alive, out of respect, and lower case after they are dead! The advantage of this advice was that it was clear-cut. (Incidentally, my spell-checker says it should be “Bunsen burner” but “diesel engine”!) But at what point can we simply say “CNT” without going to the length of defining it? In this instance I think it can be assumed that readers of CARBON do not need to have it defined, while many readers of the New York Times would need the definition. In this case it certainly depends on the publication. My personal opinion is that TEM, SEM, XRD, FTIR (or should it be FT-IR?) and many other abbreviations are now so common that there is probably no need to define them in every paper in which they are used, but defining them when first used takes very little space and may help some readers.

Commonly used variants of the above are HRTEM and FESEM, and most of us know that HR refers to “high resolution” and FE to “field emission”; but is it necessary to include these in abbreviations? I do not think so. I was told by one of my editors that a microscope becomes high resolution when it can resolve atom spacings. But what atom spacing? Graphene layers? When I started research we considered 10 Å (1 nm) to be high resolution, and when the first photographs were published resolving the graphite interlayer spacing we considered them ultrahigh resolution. Does anybody make TEMs nowadays that are not high resolution? It is often the operators who are not HR!

A recent submission to CARBON stated (in the Abstract) that the carbon had been “treated with potassium hydroxide (KOH)”. I hope all readers of the journal have enough chemistry background to be able to recognise

KOH! One can argue that in such cases it is enough to use the chemical formula, which is a standard abbreviation based on internationally recognised symbols for the elements, but some abbreviations for polymers may not be as understandable, polyethersulfone (PES) being a recent example, because they depend on the chemical name. In many cases the name, and hence the abbreviation, changes with the language. The rule here seems to be: “if in doubt, spell it out”.

In the second of the above rules I asked: “I wonder what happened to the F?” We have a similar situation with carbon nanotubes. A recent paper referred to “. . . the production of carbon nanotubes (CNTs), single-walled carbon nanotubes (SWNTs), multi-walled carbon nanotubes (MWNTs) and amorphous carbon nanotubes (ACNTs)”. I asked for advice from the Editors about the missing C in two of the definitions and was told that the abbreviations MWNT and SWNT are now accepted. True: but why should they be? Surely scientists should be logical and consistent! One Editor even suggested that abbreviations using more than four letters are cumbersome (*vide* HRTEM and FESEM above). A review of recent submissions shows that some authors use SWCNT while others use SWNT, and I suppose it will stay that way. My personal preference is to have the C there because there are nanotubes that are not carbon. But is the C in the correct place? It would be more logical to always use the abbreviations NT, SWNT, MWNT and ANT and precede them with the chemistry, so that one would have C-MWNTs and BN-SWNTs, etc.

There is one further point to be made concerning “CNT”. Do we define it to mean “carbon nanotubes” or “carbon nanotube”? Singular or plural? The answer is clear and unequivocal. It should be singular—as used above. The reason for this is subtle and raises a point about the English language that I have to point out to authors very often. In English we do not use the plural noun in an adjectival role. This is not true of most other languages. We refer to “carbon fiber composites” even though more than one fiber is involved. Likewise we speak about “carbon nanotube composites” or “CNT composites” and the abbreviation refers to the singular noun, not the plural.

One final plea: use abbreviations sparingly. A page full of abbreviations might save space but is very difficult to read. How about this from a recent submission: “ACs produced by the FBM (AC-1B, AC-3B, AC-5B, AC-7B) were examined using XRD, TEM, TPD and ESCA and found to have an L_c of 40 Å and –OH, –CO–OH, and =O SFGs.” Even with all the abbreviations previously defined the sentence is initially difficult to understand. [For the curious, FBM denoted “fixed bed method” but could equally well mean “fluidized bed method”.]

Writing scientific papers is not an easy task, particularly in a foreign language. Abbreviations have become a part of that language. The editor pleads with you to follow the above five rules when you use them, and use abbreviations sparingly. After all, if you say “carbon nanotubes” fifty

times in your manuscript rather than “CNTs” you will only make the paper about ten column lines longer, and in most cases that amount of space could easily have been saved in the Introduction.

Finally a word about titles. It is surprising that many papers are received with titles that make no sense or are ambiguous. In many cases it appears that the title is added as an afterthought. Remember that the title must be able to “stand alone”. It must be understandable without reference to the rest of the manuscript. A recent problem has been the fashion of using a colon in the title. Rather than say “The effect of annealing temperature on the properties of carbon fibers”, authors are saying “The properties of carbon fibers: effect of annealing temperature”. Why, I have no idea. The

latter is awkward and not as readily understandable as the former. Avoid “colonic” titles, and again, keep them short!

CARBON operates on a fixed annual page budget. This means the shorter the papers, the more we can publish. We are currently being forced to reject around two thirds of submissions because of page constraints. A short manuscript usually has a greater impact and, for the reasons outlined can benefit us all. “Short and sweet” is a maxim for the sciences as well as the arts.

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