Materials Science Poster and Paper Writing Tips

Jon Stolk, Spring 2015

1. **Don't write a narrative. Do make an argument.**

   Narrative: "First we decided to test the melting temperature … We cut samples for differential scanning calorimetry (DSC) analysis… then we ran DSC from 25-200 °C… our results surprised us…

   Argument: "Differential scanning calorimetry (DSC) analysis of the polymer showed a melting point of 114 °C. This value, which lies within the expected range for low density polyethylene [CITATION], may be explained by the weak van der Waals intermolecular bonding in LDPE.

2. **Don't simply report all of the facts that you gathered. Do explain the important connections among material chemistry/structure/bonding, properties, and context (e.g., performance or impacts).**

   Facts: "Our material is nylon 6/6. Nylon 6/6 has a strength of 60 MPa. Nylon is not typically recycled."

   Connections: "The relatively high strength (60 MPa) and melting point (220 °C) of nylon 6/6 arise from its strong intermolecular bonding. Unlike many commodity polymers such as polyethylene, which have only weak van der Waals bonding between chains, nylon 6/6 molecules are held together by stronger hydrogen bonds between the N-H and C=O amide groups of neighboring chains. Unfortunately, the same type of bonding that gives nylon 6/6 its strength and high melting point also makes it difficult to recycle. Compared to polyethylene, nylon recycling requires xx more energy and results in yy more degradation of the material properties. In addition, only zz percent of recycling centers in the US accept nylon products…"

3. **Don't suggest random "stuff you could do" for future work. Do suggest meaningful areas of inquiry that could address specific questions or issues with your experimental approach.**

   Random directions: "In the future, we could run more tensile tests on our product. In addition we could do more research on the expected properties of this material."

   Addressing specific issues: "The measured tensile strength values showed a large variation, possibly due to non-uniformity (e.g., volume defects) in the material or poor sample preparation. Additional testing on more carefully prepared tensile specimens may be necessary to accurately determine the material strength."

4. **Don't rely only on qualitative explanations of properties and impacts. Do use numbers from reliable sources to support your arguments.**

5. **Don't assume your property measurements are correct. Do use numbers from reliable sources to validate your experimental data and calculations.**

6. **Don't write "it makes sense…" Do explain your findings using relevant theory and empirical data as support.**

   Unsupported "it makes sense…": The natural cork helmet absorbed less energy than the synthetic polystyrene foam helmet. This makes sense.

7. **Don't overuse the passive voice.** Use passive verbs (is, are, was, were, be, been) sparingly when you need to define something ("Copper is a metal.").

8. **Don't use informal language. Do use formal technical language and terminology.**

   Informal: "The SEM analysis showed some blobs, which seems sketchy…"

9. **Don't use acronyms or symbols without initially defining what they mean. Do define all acronyms and symbols the first time they are used.**

   Failure to introduce: "The DSC showed a T_g of 43 °C…"

   Defining terms: "Differential scanning calorimetry (DSC) showed a glass transition, T_g, of 43 °C…"

10. **Don't include figures or equations just because you made them, and don't include figures without discussing them in the text. Do include figures that support your arguments.**

11. **Don't refer to your figures by location (e.g., "the figure above…"). Do assign your figures numbers and descriptive captions, and refer to them by number (e.g., "as Figure 3 illustrates…")**

12. **Don't make over-stated or overly generalized claims. Do acknowledge specific trade-offs and complexity.**

    Over-stated claim: "Nobody should use disposable razors…"

    Acknowledging trade-offs: "Despite their lower material, manufacturing, and purchase costs and similar blade hardness and lifespan, the use of disposable razors results in a xx increase in carbon footprint and yy more non-recyclable waste per person per year compared to reusable razors…"

13. **Check your document for capitalization errors. Some guidelines:**

    - Do not capitalize element names (germanium), unless you are using the symbol (Ge)
    - Do not capitalize molecule and compound names, e.g., polyethylene and silicon dioxide.
    - Capitalize trade names (Lexan, Lucite, Tyvek, Nalgene) and abbreviations (HDPE, PS, PU, PETG) for polymers.
    - Do not caplitalize equipment names, unless you're naming a specific brand and model, or unless there is a proper noun in the name. Fourier transform infrared spectrometer, scanning electron microcope, digital scanning calorimeter, Rockwell hardness tester
    - Do not capitalize property names (tensile strength, elongation) unless it includes a person's name or other formal noun, e.g., Young's modulus

14. **Do find high quality sources to support your analyses.**

    Look for sources that are reviewed and validated by experts. Examples: books, journal articles, ASM handbooks, CES Edupack (available on computers). Corporate spec sheets are often okay as a reference for property values, but the quality depends on the company. Watch for potential bias in your sources, e.g., chemical companies reporting that their products have no negative health or environmental impacts. Provide enough information in the citation that someone else can find what you're referencing, e.g., name, date, url if you are using a website.

    Please do not include random web sites as sources of material property or structural information. This includes the random notes from some professor at university x. Also, do not use "Jon Stolk or Matt Neal told me…"