



If you work with materials, then you have almost certainly encountered the most wonderful material of them all. It has amazing properties. It can manifest as a gas, solid, or liquid, and has a phase diagram unlike any that you’ve ever seen. It can be a conductor or an insulator. It can have an atomic number anywhere between zero and a Googleplex, including non-integer values. The fabulous material to which I am referring is, of course, unobtainium.

We’ve all been in meetings where someone would say, “Oh, if only we had a material that (you fill in the blank)!” For example, “if only we had a material that was a superconductor at temperatures up to 300 K.” Or “if only we had a material with all of the properties of silicon, but that flows like a Newtonian fluid at room temperature and pressure.” Or “if only we had a material that was super-hard and could not be dented or broken.” “If only we had a solar cell material that would absorb 100% of all incident light at all wavelengths.” “If only we had biomaterials that would allow growth of replacement organs on demand.” At this point in our understanding of materials, these materials are merest fantasy, (i.e., unobtainium).¹

The worlds of science fiction and fantasy are filled with references to fantastic materials.² The Marvel universe (in comic books, movies, television series) has introduced us to adamantium,³ a super-hard metal that forms Captain America’s shield, Wolverine’s claws, and the outer body of Ultron. Adamantium also appears in various forms with a number of other Marvel characters.⁴ Imagine an automobile body made of adamantium. Dents and scratches would be a thing of the past. Never, ever! Unless, of course, you ran into the Incredible Hulk or Thor’s hammer, Mjolnir. Sharp objects would never dull. You would never have to replace your razor blades, or sharpen knives or shears. You could cut through almost anything. Oh, if only we had a material like adamantium.

If you are familiar with the universe populated by Superman and his colleagues (in comic books, movies, and television shows), you have probably heard of Kryptonite.^{5,6} My first encounter with Kryptonite was the green form. Over the years, the stories have identified at least 22 different types of Kryptonite in many different colors such as green, red, gold, and black. Kryptonite is almost always identified as a product of the huge explosion that obliterated Krypton (Superman’s home planet), although there have been some forms of Kryptonite that were artificially produced (e.g., x-Kryptonite, magno-Kryptonite, and various alloys such as green-red). However, in some cases, Kryptonite is identified as an element, while in other cases, it is identified as a mineral.

Some discussions suggest that Kryptonite is a super-heavy element—perhaps with a very high atomic number, but it must also be very stable.⁷ Other reports have identified Kryptonite as an element





W E L C O M E S S U B M I S S I O N S

with atomic number 126, unbihexium, a trans-plutonium element centered in the island of stability of the super-heavy elements. The identification as a mineral seems more natural to me because of the form of the name (with the “ite”), but not being from Krypton, I admit that could just be Terran bias.

Kryptonite exists in both noncrystalline and crystalline forms. Exposure to most forms of Kryptonite have very little immediate effect on people from earth (Terrans), but can cause sickness and death (green form) as well as personality changes (red form) and other effects in natives of Krypton. Long-term exposure to some forms of Kryptonite can cause cancer in Terrans. Unfortunately, the accuracy of these observations is called into question because the historical record indicates that the effects associated with the different forms of Kryptonite have changed over time. The record is further muddled in that it appears that the properties and effects of Kryptonite can be affected by magic. Note, for example, Superman’s encounters with Mr. Mxyzptlk.⁸

The record also reflects that all forms of Kryptonite are radioactive. Consequently, it is reasonable to assume that it is the radiation emitted by Kryptonite in its various forms that affects Kryptonians. This radiation must be different than the radiation with which we are familiar, because those forms of radiation (e.g., gamma-rays, x-rays, neutrons, beta-rays) affect Terrans. Exposure to a large enough dose of these types of radiation can cause sickness and death among Terrans, whereas the effects of some forms of Kryptonite on Kryptonians dissipate rapidly once the Kryptonite is moved far enough away. Since short-term exposure to Kryptonite holds no such hazards for Terrans, we must accept that the radiation emitted from Kryptonite is different and maybe very exotic. Perhaps, it is the fabled dark energy or dark matter⁹ that Terran scientists have sought feverishly for many years. I note that whatever it is can be shielded by lead, similar to x-rays and gamma-rays, so that maybe it is electromagnetic in nature. Finally, I note that X-Kryptonite (not to be confused with Kryptonite-X) may give super powers to Terrans.⁵ Say it with me now—“Oh, if only we had a material that was like X-Kryptonite that could give us Superman-like powers!”

In the real materials world, much has been made recently of additive manufacturing (3D printing),^{10,11} as opposed to subtractive manufacturing.¹² Additive processes may revolutionize manufacturing. The realm of fantasy also has its additive and subtractive processes. Terry Goodkind’s series *The Sword of Truth*¹³ involves a wizard named Richard Rahl, who is beset by all sorts of evil. As a young man, he doesn’t know his heritage, nor does he know that he has magical abilities. Gradually, with the help of his grandfather (the wizard Zedd) and his lifemate (the Mother Confessor Kahlan), he becomes aware that he is the rarest of wizards, able to wield both additive and subtractive magic. This allows him to solve all sorts of problems and to defeat even the most evil of foes. As long as I’m going to wish for adamantium and X-Kryptonite, I may as well go further. “Oh, if only I could wield both additive and subtractive magic to cure the ills of the world.” Alas, that is not likely to become truth. What I do believe to be true is that materials research is the best opportunity for us to develop truly magical materials that will solve tomorrow’s problems.

Steve Moss

References

1. <https://en.wikipedia.org/wiki/Unobtainium>.
2. https://en.wikipedia.org/wiki/Materials_science_in_science_fiction.
3. <http://marvel.wikia.com/wiki/Adamantium>.
4. <https://en.wikipedia.org/wiki/Adamantium>.
5. <https://en.wikipedia.org/wiki/Kryptonite>.
6. <http://entertainment.howstuffworks.com/arts/comic-books/kryptonite1.htm>.
7. <http://superman.wikia.com/wiki/Kryptonite>.
8. <http://the-artifice.com/superman-villains-who-dont-need-kryptonite>.
9. <https://science.nasa.gov/astrophysics/focus-areas/what-is-dark-energy>.
10. https://en.wikipedia.org/wiki/3D_printing.
11. “3D Printing of Biomaterials,” *MRS Bull.* **40** (2)(2015).
12. <https://en.wikipedia.org/wiki/Machining>.
13. https://en.wikipedia.org/wiki/The_Sword_of_Truth.

MRS Bulletin welcomes submissions to Posterminaries. Description: Light commentary and observations relating to anything of interest to the *MRS Bulletin* readership. Topic must have a materials angle. Word play is a plus. Length: 1400–2000 words. Format of submission: Email as a Word document to Bulletin@mrs.org. Examples: www.mrs.org/posterminaries.