Advice & Counsel

Frank Altmayer, MSF, AESF Fellow
AESF Foundation Technical Education Director
Scientific Control Labs, Inc.
3158 Kolin Ave., Chicago, IL 60623-4889
E-mail: altmayer@sbcglobal.net

Covering the Bases: Part I

Dear Advice & Counsel,
While my company plates onto a wide variety of base [basis] metals, the majority of articles we process are made of various brass alloys. I can't say I have much expertise on the subject of brass, but I'd like to at least get some basics. For example, I have heard of "dezincification" of brass, but I'm not sure how or why that would happen. Then there is stress corrosion cracking which we have experienced periodically. How about a primer on the subject?

Signed,
Cupfer L. Oye

Dear Ms. Oye
With some help from various references, I'd be glad to try. We can begin by stating that brass is a metal "alloy" containing copper and zinc and in some cases other alloying elements. Most metallic articles that are metal finished are not pure metals, but combinations of metals and/or combinations of metals and non-metallic ingredients. Alloys are produced by combining the various ingredients while the main metals in the alloy are in the molten state. In the case of plain brass, the copper and zinc or zinc-bearing ore are heated to a point in which the two metals dissolve into each other. When the alloy solidifies, we end up with a solid state "solution." Most of today's brass is produced from melting scrap, which explains some of the reduced quality one sees.

If we look under the microscope at polished and etched brass that contains copper and zinc (and little else), we cannot distinguish any copper and we cannot see any zinc. We see a sea of grains of what looks like a single metal, as in Fig. 1.

There are hundreds of brass alloy variations produced by adding one or more additional elements to the copper and zinc. Further the copper content of brass may vary from 45 to nearly 100% copper. The most commonly added alloying elements (aside from copper and zinc) for brass are listed in Table 1.

Table 1
Alloying elements and compositional ranges for brass

Lead	0.1 - 12.0
Aluminum	0.1 - 3.0
Tin	0.5 - 6.0
Nickel	0.5 - 30.0
Iron	0.1 - 2.0
Silicon	0.1 - 2.0
Manganese	0.05 - 25.0
Phosphorus	0.01 - 0.10
Arsenic	0.01 - 1.0
Antimony	0.01 - 0.10
Gold	0.5 - 1.0
Bismuth	0.1 - 3.0
Vanadium	0.1 - 0.50
Tungsten	0.1 - 2.0
Chromium	0.05 - 0.5

Some of the more important alloying elements for brass include:

- Aluminum, which makes the brass more corrosion-resistant.
- Tin, which also enhances corrosion resistance, especially in sea water (naval brass)
- Lead, which increases the ease of machining with lead acting as a solid lubricant.
- Combination of aluminum, silicon, iron and manganese to make the brass tougher (more wear and impact resistant).
- Brass alloys are often referred to by "names" that have been given to the alloys. Table 2 lists some of the more common names.

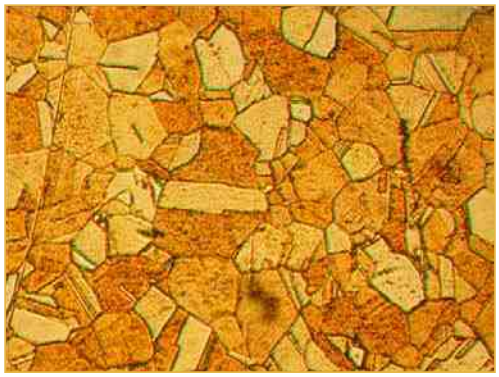

Figure 1—Cross-section of cast brass (Photo: Wikimedia Commons).

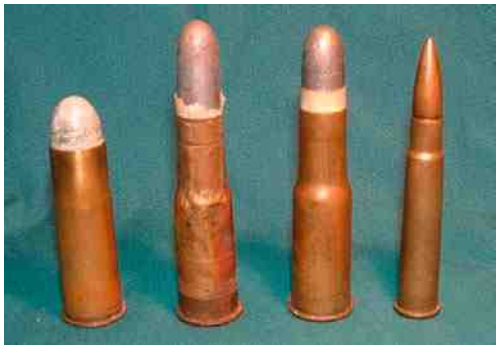

Figure 2—Brass rifle cartridges (Photo: Wikimedia Commons).

Brass can range from very soft to hard alloys with high tensile strength (over 100,000 psi) alloy castings. Because it is softer than most other metal alloys, brass-based tools may be employed in conditions where a spark might cause an explosion.

Brass has a higher malleability than either of the two metals that make up the primary ingredients. The low melting point (900 - 940°C) and excellent flow characteristics allow for the production of parts via casting extruding, drawing or stamping. Drawings such as the rifle cartridges shown in Fig. 2 are typically produced from 70/30 (CDA260) brass containing little else.

This discussion will continue next month. **P&SF**

Table 2
Common names for brass alloys

Admiralty or Naval brass:	30% zinc + 1% tin for enhanced corrosion resistance in sea water.
Alpha brass	25 - 35% zinc; can be cold worked to produce forgings and drawings with an alpha or FCC (face centered cubic) structure.
Alpha-beta brass or Duplex Brass	35 - 45% zinc used in hot working applications (temperatures above the recrystallization temperature). This alloy contains both α (FCC) and β (BCC) crystal structure. The BCC structure is harder/stronger than the FCC.
Beta Brass	45 - 50% zinc content, typically used for castings. The structure is all BCC.
Aluminum brass	Contains 1 - 3% aluminum for added corrosion resistance
Arsenical brass	Contains up to 1% arsenic for higher melting point applications such as boiler components.
Cartridge brass	30% zinc brass suitable for deep drawing (cold working).
Bronze	5 - 10% zinc content; may be called bronze or "Guilding metal," but is not a true bronze (copper-tin alloy). Copper-zinc bronzes may be used in some munitions applications.
High brass	35% zinc content; has a high level of hardness and is typically used for fasteners and springs.
Low Brass	20% zinc content; yields a high level of ductility, as might be needed in producing flexible hose or pipe.
Muntz Metal	40% zinc and 0.5% - 1.0% iron. Muntz metal historically was used as an anti-fouling surface for boats/ships.
Red brass	Also known as gunmetal, one version of this alloy contains only 2% zinc and 10% tin (balance copper). This is not a true brass alloy.
White brass	More than 50% zinc content; this alloy was electroplated as an imperfect substitute for nickel during World War II. It proved to be very brittle and poor in corrosion resistance, even under chromium.
Yellow brass	About 33% zinc content.

Fact or Fiction?

Continued from page 26.

Tom Bethell reports, "Overnight, millions of Africans now had AIDS, by these criteria." The definition was so broad that 'almost anyone in any African hospital could be said to have it,' says Rian Malan. Let's say you're in the Congo. You go to a doctor because you're feeling weak. You've lost weight and have had a recurring fever for a few weeks and a persistent cough. Doctors are now free to say that you have AIDS. For a child, all they need is weight loss, diarrhea and a cough."[7]

Weird isn't it? No debate that AIDs is a terrible, debilitating disease. Yet, since the time this definition was put in place and cases have skyrocketed, the population of sub-Saharan Africa has increased (not decreased) by 299 million people - slightly less than the present entire population of the United States.[8]

Summary

Katherine Arnold notes, "Health stories rank third in topics covered on the evening network news. There are about 120 health or fitness consumer magazines in the United States and about 65 regional newspapers that cover health or medicine as a beat, and health news is at the top of the list of important issues for people 50 and older."[9]

Clearly, we are bombarded by health stories, yet most folks have only a "headline, magazine or TV news" awareness of the issue of concern. More often than not, these stories overemphasize minute risks about which little can be done and ignore those that people can do something about. Repeated often enough, these scares eventually become myths and most people never hear the full story. Sometimes the rules for diagnosing diseases are changed but this gets lost in all the fear-mongering.

So my suggestion for you is, the next time you hear some new science or health scare fact, try to find the rest of the story and not just the headline scare. What was the sample size? Did some committee change the guidelines for an illness or disease? There are not mad cows on your block. Ebola is not lurking in your drain and you are not going to die from SARS, West Nile Virus or bird flu. Your family is not threatened by chemical assaults. They're threatened by people with a blood alcohol level of 0.25 driving two tons of steel. **P&SF**

References

1. Rodger Doyle, *Scientific American*, **284**, 26 (May 2001).
2. Paul Campos, *The Obesity Myth: Why America's Obsession with Weight is Hazardous to Your Health*, Gotham Books, New York, NY, 2004; p. 22.
3. Sandy Szwarc, "Now an epidemic of hypertension?" *Junkfood Science*, October 14, 2008; http://junkfoodscience.blogspot.com/2008/10/now-epidemic-of-hypertension.html (last accessed March 30, 2010).
4. Julia Hippisley-Cox, *et al.*, "Derivations and validation of QRISK, a new cardiovascular disease risk score for the United Kingdom: prospective open cohort study," *British Medical Journal*, **335** (7611), 136 (July 21, 2007); http://www.bmj.com/cgi/content/full/335/7611/136 (last accessed March 30, 2010).
5. Polly Curtis, "1.5m wrongly told they risk heart disease," *Guardian Unlimited*, July 6, 2007; http://www.guardian.co.uk/society/2007/jul/06/health.medicineandhealth (last accessed March 30, 2010).
6. Scott O. Lilienfeld & Hal Arkowitz, "Autism: An Epidemic?" *Scientific American Mind*, **18**, 82 (April/May, 2007).
7. Tom Bethell, *The Politically Incorrect Guide to Science*, Regnery Publishing, Washington, DC, 2005; p. 107.
8. Tom Bethell, *ibid.*; p. 118.
9. Katherine M. Arnold, "Medicine in the Media: Symposium Addresses Challenge of Reporting on Medical Research," *Science Editor*, **26**, 17 (January-February, 2003).