Positions Available

POSTERMINARIES

Brazenly Chilly

Winter. Having recently moved to the American Midwest, I am being exposed to continental airmasses for the first time and the associated cold, the breathtaking degree of which calls forth crass, popular expressions incorporating "brass" in the simile. These analogies are anatomical in nature and relate to the cold sensation caused by touching a metal surface or to a postulated temperature-induced brittle fracture.*

What strikes me, of course, is how these figures of speech consistently refer to brass. The poetic creators of these adages used the common observation (the coldness of metal) that is caused by the difference in temperature between a body part—let's say, our hand—and metal. Heat is extracted from our hand to bring the metal up to our skin temperature, in accord with the second law of thermodynamics. Metal feels cold because the amount of heat required, and therefore the cooling of our skin, is large. In scientific terms, the effect results from the presumably large heat capacity of the material (requiring more heat from our hand to raise the temperature) and the large thermal conductivity (requiring us to heat a large volume of the material). The question, though, is whether the choice of brass for these expressions is merely "poetic" or based upon rigorous observation. Does brass have a significantly larger heat capacity or thermal conductivity than other metals or alloys, and therefore feel colder than others?

Another cold analogy seems to imply that the ambient temperature is below the ductile-to-brittle transition of brass. Again, we must ask if this implies an especial level cold, or if it is just another "poetic" expression. Is the DBTT (ductile-to-brittle transition temperature) for brass notably lower than for other metals, revealing a subtlety of observation hitherto not understood?

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So off (through the cold) to the library. Some data just cannot be found on the web. First, I investigate the tactile coldness phenomenon. The room-temperature heat capacities of a wide range of metals and alloys can be found quite readily, and they fall in a range between about 0.13 and 0.88 kJ/kg K, with most brasses in the low-to-middle part of the range at about 0.385. The data do not seem to favor the phrase-turners. Just to be sure, I checked the thermal conductivities, and brass is a middling kind of alloy on that scale, too. Steel typically has a larger heat capacity, but a lower thermal conductivity, and should feel just about as cold as brass. Lead exhibits low numbers and does not feel very cold, while copper and aluminum should both feel colder than brass. About now, I am beginning to think that I should be submitting these findings to the *Journal of Irreproducible Results*.

On, then, to the question of brittle brass. Does it exist? Is there a well-defined DBTT? Well, the evidence is not so clear. Ductile-to-brittle transitions are characteristic of metals which have a sharp inverse relationship of yield strength and temperature, the classic case being steel. Nowhere do we find any discussion of a DBTT in brass, after an exhaustive (say 15-minute) search, including a chat about the weather with a friendly librarian. We conclude that *if* there is a DBTT in brass, it is indeed at a VERY low temperature.

Is there, then, any scientific basis for referring to brass in these popular expressions? In the case of tactile coldness, a definite "no." For the brittle analogy, a less emphatic "no," slightly tinged with "maybe." Phrase-turners do not, it seems, make good materials scientists.

ALEX KING

*In keeping with good taste, the author and editors defer to the readers' own knowledge of indelicate English epithets.