Re: How do you calculate the specific heat of an alloy?

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From: Repeating Rifle (*salmonegg_at_sbcglobal.net*)
Date: 01/20/05

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in article 1106247786.686984.21260@z14g2000cwz.googlegroups.com, jalbers@bsu.edu at jalbers@bsu.edu wrote on 1/20/05 11:03 AM:

> *How can the specific heat of a metal alloy be calculated, if the*
> *percentages of the different metals contained in the alloy are known*
> *and the specific heats of the individual metals are known as well? Any*
> *help would be greatly appreciated. Thank You*
>

A reasonable estimate can be made using the law of Dulong & Petit. It is based upon the statistical mechanical concept that each atom contributes the same amount of heat capacity. That is, each atom contributes 3kT because it has potential energy and kinetic energy from each of the three dimesions of kT/2. Debye realized that these energies could be counted by looking at the modes of vibration of the solid instead of the individual atoms.

The problem is that quantum effects enter the picture. As in black body radiation, high energy (frequency) vibrations may not get excited fully. For soft substances, this is not a problem. But for stiff substances such as diamond or some ceramics, the stiffness means that many of the vibrations are at high frequency. Certainly, composition affects crystal structure and consequence stiffness.

At very high temperatures, other modes beside the vibration modes can get excited. Electrons in a metal, for example, usually do not add much to heat capacity at low temperature.

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