

Cryogenic Soldering

The question frequently arises, "What kind of solder should one use when doing cryogenic soldering". There are two important questions to answer. The first question is, "What is cryogenic"? The second is, what solder alloy(s) can be used?

Cryogenic is a term used to describe temperatures at or near absolute zero. Absolute zero is defined as the "Temperature at which the volume of a perfect gas theoretically becomes zero and all motion ceases: -273.13°C or -459.4°F".^{1.}

Certain applications such as superconductors require working with liquid nitrogen. The listed temperature of liquid nitrogen is -210° C.^{2.} Working with liquid nitrogen is considered a cryogenic application. On occasion researchers also deal with liquid hydrogen. The temperature of liquid hydrogen is listed as -252° C.^{3.} Any applications involving liquid hydrogen are also considered cryogenic applications.

The choice of solder alloy is important for cryogenic soldering. The standard tin lead alloys become extremely brittle and loose their tensile strength at cryogenic temperatures.

There is one alloy that does not become brittle or lose its tensile strength. The alloy is Sn95Bb05. This alloy gains considerable tensile strength at cryogenic temperatures. The closer to absolute zero, the stronger this alloy becomes.

There is a chart that lists the tensile strength information on many of the more common solder alloys. There is strength information of a few alloys at elevated and cryogenic temperatures. You can find the chart at the Knowledge Base under the category "Alloys". The chart can be downloaded from the article "Alloy Properties."

References:

- 1. Richard J Lewis, Hawley's <u>Condensed Chemical Dictionary</u>, Van Nostrand Reinhgold Company, New York, NY, 1993, p 2
- 2. Ibid., p 827
- 3. Ibid., pp 614-615