Soldering without lead

Solders composed of lead and tin have long served as the "glues" that tie together electronic components. In recent years, however, concerns about the toxicity of lead have prompted searches for alternative solders that perform just as well or better. By adding a small helping of zinc to an alloy of tin and silver, researchers have created a new solder that appears to fulfill most of the requirements.

"Up until very recently, people really hadn't considered very many options," says Mark McCormack, a metallurgist at AT&T Bell Laboratories in Murray Hill, N.J. "We wanted to find some sort of alloy addition that we knew would increase the strength [of a tin-silver alloy] but not compromise the alloy in other respects. Surprisingly, we found one with exemplary properties." McCormack and his co-workers describe their results in the July 5 APPLIED PHYSICS LETTERS.

The researchers started with a tin alloy containing about 3.5 percent silver. The silver normally combines with a small portion of the tin to form microscopic, branched, needle-like structures, which lie embedded in the remaining tin. Looking for a metal element that would dissolve in silver but not in tin, they chose zinc as the best candidate. Scientists had avoided zinc in the past because of its tendency to promote corrosion and because of molten zinc's reactivity with air. But because modern processing techniques in the electronics industry often require oxygen-free environments, handling zinc no longer presented special difficulties.

McCormack and his co-workers found that adding 1 percent zinc to the mix produced a much stronger solder than tin-silver by itself. Corrosion was not a problem because the zinc atoms stayed out of the regions of the alloy made up of pure tin. Instead, they replaced some of the silver atoms in the silver-tin grains. Zinc's corrosion potential decreases greatly when it is combined with a corrosion-resistant element such as silver.

The addition of zinc also altered the appearance of the tin-silver grains in the alloy. Instead of needles, the researchers found smaller, rounded grains that were closer together and more uniformly distributed. This change in the alloy's microstructure probably accounted for its increased strength without an accompanying increase in brittleness.

House gives thumbs-down to the SSC

On June 24, the House of Representatives defeated, by a 280-to-150 majority, a proposal that would have provided $620 million to fund construction of the Superconducting Super Collider (SSC) in the coming fiscal year. Last year, the project faced a similar fate, but the Senate restored funding (SN: 7/11/92, p.30). This time around, the vote in the Senate is likely to be much closer.

About $1.5 billion has already been spent on the SSC, covering the development of special superconducting magnets, the acquisition of land, and the start of construction of the particle accelerator's 54-mile circular tunnel and other facilities. The SSC's total cost could reach more than $11 billion by the time of its completion in the year 2002.

Earlier this month, Energy Secretary Hazel O'Leary criticized the Universities Research Association, Inc., a consortium of 80 research universities that manages the project, for demonstrating poor business practices. These practices included wasteful expenditures, faulty cost estimates, and lax supervision of contractors, she said.