Technical Note on Hermetic Packaging

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The same welding technology used to seal semiconductors can be used for other products. Most solid-state products are sealed in clean dry nitrogen gas. Sometimes helium tracer gas is added to facilitate leak testing. Some customers specify argon fill gas that, while more expensive than nitrogen, presents no technical challenge. Essentially, any nonexplosive, noncorrosive, nonpoisonous gas that can be used to fill an environmental chamber can be used as a fill gas. Expensive gases such as xenon are sometimes specified. Hermetric has developed special mini-chambers that can be evacuated and backfilled with these gases with only a few cm^3 gas lost for each part sealed. If one decides not to backfill the part with gas, then one can seal a vacuum inside the minichamber. The procedure is shown in Fig. 1. Many products such as transducers, MEMS, and SAW devices, perform better at low gas pressure. In addition, the dew point temperature can be lowered by sealing at lower pressure. Figure 2 shows a welded vacuum-sealed package containing an electronic device that will not operate at atmospheric pressure.

A characteristic that makes the projection welding process so versatile is the adiabatic nature of the heat-

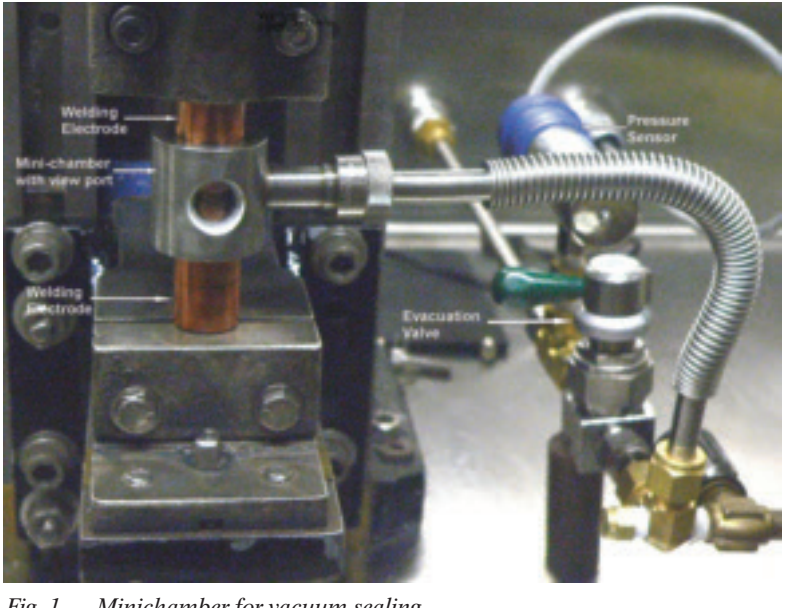

Fig. 1 — Minichamber for vacuum sealing.

Fig. 2 — Vacuum-welded, 0.60-in.-diameter package.

ing. The welding cycle can be so rapid (a few milliseconds) that very little heat transfers to the surroundings. As a result, almost no change in weld parameters is required to seal in different environments. In fact, the process can be so adiabatic that it makes little difference whether the environment is vacuum, gas, or liquid. Because of this, parts can be completely submerged in fluid during the welding process with no change in weld schedule. Some of the fluids sealed into containers include the following:

- Water — for high-pressure applications
- Fluorocarbons — for high-pressure dielectric applications
- Oils — for dielectric applications

Dielectric fluids have been sealed into electronic packages for high-pressure deep-submergence missions. Currently, evaluations are being made for sealing acids into components such as wet tantalum capacitors, electrolytes into batteries, and refrigerants into cooling systems. The ability to seal fluids in containers circumvents the common procedure of sealing a container with gas in it, then replacing the gas with a fluid through a small hole (fill port) in the container, and finally sealing the fill port to contain the fluid. Another advantage of the process is that when evacuating a component from a fill port, the time to evacuate increases as the fill port size becomes smaller. When evacuation occurs prior to sealing, the fill port is not required, and the entire container volume is exposed to the backfill source whether it is vacuum, gas, or liquid. The result is a significant reduction in processing time.

This technique would be difficult or impossible with other joining technologies, and is a direct result of the adiabatic nature of projection welding. The capacity to weld parts with seal perimeters from a small fraction of an inch to as long as ten linear inches is available. The maximum seal perimeter is limited primarily by the current the welding machine can supply. Presently, tabletop-size welding equipment can supply >150,000 A of welding current, and operate from a 120 VAC-10A-1Ø outlet.◆

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