NiobiumVs. Tantalum Caps

Bernard Levine - April 08, 2002

Niobium vs. tantalum capacitors—the debate rages.

Newly developed niobium capacitors are being heavily scrutinized throughout the industry, but many also note the advantages of tantalums and their recently improved availability and declining prices.

Nevertheless, many users burned by the tantalum capacitor shortages and high prices of just two years ago, and the uncertainty of what the future might bring are checking out their options.

"With high pricing, long lead-time and reliability concerns, it may be worth pursuing alternatives," noted Jim Heck, a component engineer at Honeywell International, Olathe, Kan., in a paper at the recent Capacitor and Resistor Technology Symposium (CARTS) in New Orleans.

High-capacitance voltage, low ESR, volumetric efficiency, low leakage current, reliability, multiple sources, and very efficient noise filtering characteristics "are some factors why tantalum capacitors have been selected for filtering in power supplies and other applications," Heck said. "However, due to the recent industry trends, tantalum capacitors suffered long lead-times and escalated pricing. Reports of one-year lead-times for the high-capacitance voltage tantalum capacitors were common. Reliability also becomes a concern for both radial and surface mount capacitors. Accelerated thermal runaway and excessive leakage current are common failure modes."

Heck, whose Honeywell unit builds aircraft radios, added "there is no clear-cut answer on tantalum capacitor alternatives? They are application-specific. Aluminum electrolytic, film, polymer aluminum, ceramic and fusible tantalum capacitors have been successfully used as tantalum capacitor alternatives. Military-qualified tantalum capacitors may be another alternative yet, though they may not be cost-effective."

And niobiums may be a key new option, a number of other CARTS papers indicated. The middle, commodity range of the electrolytic market may be especially viable for niobiums, some suggest.

Capacitor customers "are evaluating, based on what happened in 2000 and the low cost of niobium," said Glyndwr Smith, assistant to the CEO and senior VP at Vishay Intertechnology. "Tantalum capacitors now have reached their limits in terms of price reduction; they are back to levels of prices prior to 2000."

Vishay and most other leading tantalum cap makers have begun sampling niobiums. But Kemet's John Warner, director of investor relations, said that user interest in replacing tantalums is declining. "The world is awash in tantalums today. As price comes down, the whole issue of replacing tantalums will go down and interest in niobiums will wane. It has already. We have niobium samples available, but very few customers have taken us up on that."
But a CARTS paper by Yuri Pozdeev-Freeman and Pete Maden of Vishay Sprague, Sanford, Maine, said, "the recent supply shortage of tantalum capacitors and rising cost of tantalum powder renewed interest in niobium as a possible substitute for tantalum in solid electrolyte capacitors. Tantalum and niobium are ‘neighbors’ on the periodic table; they have many similarities in crystalline structure, physical and chemical properties; for a long time they were thought to be the same chemical element. Compared to tantalum, niobium is plentifully available. Niobium is also more economical to use as a capacitor substrate; the current price per pound of raw niobium ore is a tenth of that for tantalum ore."

H. Zillgen, M. Stenzel and W. Lohwasser of EPCOS AG's capacitor division in Germany said, "the replacement of the anode material in tantalum capacitors by a new generation of high CV niobium powders offers the possibility to get an economical alternative to tantalum for a wide range of applications. Due to the high CV potential of niobium powder, there is also an alternative to low-voltage aluminum electrolytic capacitors."

Meanwhile, the tantalum powder needed to make tantalum capacitors, which is refined from tantalum ore, was in tight supply during the boom of two years ago but is more readily available now. Political issues have also been raised about some sources of the tantalum ore, such as warring factions in the Congo allegedly selling stolen or illegally mined ore. Tantalum powder supplier H.C. Starck believes tantalum should be readily available in the future at a fair price from legitimate sources. In a CARTS paper, a Starck team contended “the future for the tantalum supply chain is very bright,” with tantalum material shortages “a thing of the past.”

Tantalum capacitor manufacturers and powder processors have sufficient tantalum to meet a 20 percent average annual growth rate until 2006 and a 10 percent average annual growth rate until 2010, the team contended, and tantalum resources will be abundant for the next 125 years.