

## Microfluidizer® Processor Technology Saves Maker of Electrical Capacitors Over \$1 Million Dollars Per Year

KEMET Electronics, Inc. of Greenville, NC (NASDAQ symbol KMET) is one of the world's leading suppliers of electrical ceramic capacitors with about 12% of the market. In 1995, KEMET began a program using the Microfluidizer processor that sharply reduced the amount of dangerous chemical waste that needed to be disposed of, and in the process saved itself over \$1 million a year in materials costs.

Kemet's Shelby, NC plant manufactures ceramic capacitors that use barium titanate to form the dielectric layers within the capacitor. A dielectric is a catalyst for electron transfer. It lets the capacitor act like a miniature storage battery that holds and discharges electric voltage. Capacitors are used in virtually all electrical appliances, typically to smooth out or control variations in a circuit's voltage, for example, to tune a radio's frequency of modulation or to convert alternating current into direct current in a battery charger. How much charge a capacitor can hold in a given circuit is rated by its capacitance, which varies depending on the width and number of dielectric layers present as well as on the total width of the capacitor. The issue with barium titanate is that, at \$3,000 for a 250 kilogram batch, it is expensive. It is also a hazardous waste. So the less of it KEMET can use and still produce capacitors that are on spec, the better.

That is where the Microfluidizer processor comes in. It allows KEMET to reclaim barium titanate that would otherwise be wasted in the manufacturing process and have to be disposed of. Here's how Bill Pellerin the manufacturing engineer in charge of the process describes it:

"To make a capacitor, we start with a dielectric sheet, which is like a thin layer of paper. Ink is printed on each sheet which acts as an electric conductor and the sheets are layered up, creating a sandwich with the correct number of layers. This sandwich, which is 10X10 inches is then backed in a firing kiln to 1600° Fahrenheit, which turns the layers of sheets into a hard ceramic. This ceramic is then cut into 30 to 40 separate cubes, each of which is a capacitor. But not all the ceramic makes it into a capacitor; there is waste, and this waste is vacuumed up and reused."

"In the reclaiming process, the ceramic scrap is pulverized and put into a big mixing tank; chemicals and water are added, and the mixture is blended for eight hours. Then it is sent through a model M-110EH Microfluidizer processor at a continuous pressure of 10,000 psi. From there the reclaim, or slip as we call it, goes back onto a caster where it dries after another eight hours and is slit back into sheets."

"The reason for the Microfluidizer processor," Pellerin says, "is that even after the ceramic is thoroughly pulverized and mixed with water in the tank, it can't dissolve in liquid. We need the Microfluidizer [processor] to break up the lattice structure at the molecular level. If we were to just stop the blades on the blender, the lattice molecules would simply attach themselves to the water molecules and all you'd be left with is very thick mud. What the Microfluidizer processor does is break down the lattice structure so that it doesn't grab all those water molecules. After it goes through the Microfluidizer processor it is stable so that it doesn't solidify and it doesn't settle out."



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KEMET uses the reclaim sheets to add extra thickness on the outside of the capacitors (reclaim can't be used inside the sandwich). The extra layers top and bottom are used to bring the thickness of the capacitor into spec. The virgin dielectric is so efficient that when it's placed in a capacitor you may only build up to 20 thousandths of an inch after 40 or 50 layers. But the spec may call for 40 or 50 thousandths of an inch. So we use the reclaim to make up the difference. That's a lot less expensive than adding more virgin dielectric.

## **Phenomenal Results**

Using the reclaim saves KEMET \$300/batch, or about 10 percent of its materials cost. At seven batches per week, that adds up to over \$1 million a year. There are additional savings from not having to dispose of so much hazardous waste; and of course, there is the extra benefit of using a process that is much more environmentally friendly to begin with.

Pellerin credits the Microfluidizer processor 100%. “The Microfluidizer processor is the only way that lets us do this. It is the only device that breaks up the materials. And, it is the only device that can hold up to the tremendous pressure and abrasive action of forcing bits of ceramic dust through stainless steel tubing at 10,000 psi. It's like sandpaper, only a thousand times worse.”

To improve performance even further, in mid-1997 KEMET installed a Seal Quench Option on the Microfluidizer processor. Seal Quench allows users to apply water, alcohol or other solvents directly to the plunger/seal area of the processor's pump. The fluids cool and clean the plunger, extending seal life which helping to prevent contamination of the user's product.

“Results have been phenomenal,” Pellerin states. “We could never have done this without the Microfluidizer processor. For KEMET it's just like someone started writing us a check every month.”



30 Ossipee Road  
Newton, MA 02464-9101 USA  
617-969-5452  
800-370-5452  
Fax 617-965-1213  
mixinginfo@mfics.com  
www.microfluidicscorp.com

A DIVISION OF **MFIC**  
CORPORATION

**European Office**  
Edisonstr. 15  
68623 Lampertheim, Germany  
Tel: +49 (0) 6206-503-702  
Fax: +49 (0) 6206-503-705  
microfluidics@t-online.de  
www.microfluidicscorp.com