Center for Dielectric Studies (CDS)

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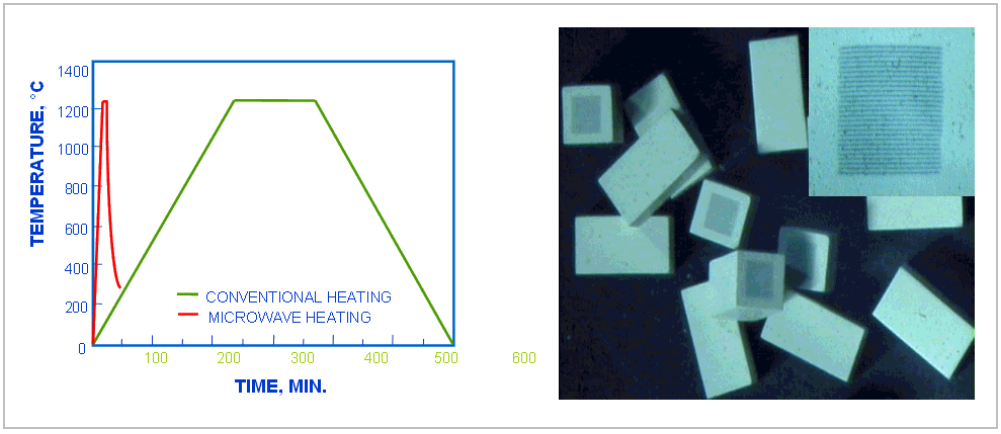
Microwave Sintering

Although the general technique of microwave sintering of electronic devices has been known for some 25 years, it has not been applicable in industrial practice to date. CDS has developed microwave sintering of electronic devices to levels that have not been observed before. The center has demonstrated parts made via this technique that are comparable to standard production parts. The potential of microwave sintering in the electronics industry is large because it will reduce sintering costs and increase efficiency and throughput. For more information, contact Dinesh Agrawal 814-863-8043, e-mail: dxa4@psu.edu or Rustum Roy, 814-865-3421; e-mail: rroy@psu.edu.



Left: Vastly improved production of base metal multilayer ceramic capacitors using microwave sintering techniques. *Right*: Examples of microwave sintered multilayer ceramic capacitors with nickel electrodes.

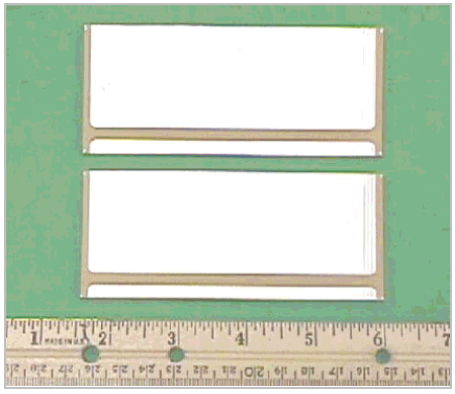
Low-Temperature Co-Fired Ceramics

Center research illustrated curvature changes in low temperature co-fired ceramic (LTCC) substrates under various heating rates and firing times and temperatures with various LTCC materials. LTCC materials are used for packaging applications. The work was fundamentally helpful to Dupont, Ferro and Heraeus in their development of LTCC materials systems. For more information, contact Gary Messing 814-865-2262; e-mail: messing@matse.psu.edu.

Chemical Modeling of Base Metal Electrode Multilayer Ceramic Capacitor Systems

The Center for Dielectric Studies (CDS) research has generated a fundamental understanding of base metal electrode multilayer ceramic capacitor systems. The results have led to improved reliability of these capacitors, which are widely used in computers, telecommunications, aerospace applications--wherever electronics are used. CDS developed a model elucidating the chemistry of rare earth lanthanides in these devices: they are amphoteric, residing on the A or the B site of the barium titanate perovskite lattice. This model has been thoroughly tested and is now widely accepted in the electronic components community. For more information, contact Clive A. Randall, 814-863-1328; e-mail: car4@psu.edu.

Pulse Power Capacitors



CDS researchers at the University of Missouri-Rolla are fabricating large-scale capacitors for pulse power applications. These systems are being tested by center members Lawrence Livermore National Laboratories, Honeywell FM&T, and Sandia National Laboratories for rapid discharge of high-energy capacitors. Previous technology used low dielectric constant materials, which are not useful for mobile applications. Center research on increasing the dielectric constant and the breakdown strength is making it possible to reduce the weight and volume of such capacitors. Applications include military communications equipment and future combat systems, aerospace and avionics, power conditioning systems, cardiac defibrillators, X-ray equipment, pulse forming networks for radar, radio and TV, lasers, accelerators, ignition systems, and electric vehicles. For more information, contact Dr. Harlan Anderson, University of Missouri-Rolla, 573-341-4886; e-mail: harlanua@umr.edu.

Above: Large high voltage capacitors for pulse power fabricated at CDS-Rolla.