



### DESIGN OF CHEMICALLY BLOWN EPOXY FOAMS

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Polymeric foams based on epoxy or urethane systems often have limitations when complex geometries for electronic component encapsulation are being foamed. As reactive resins they may crosslink either too early resulting in flow limitations and insufficient fill, or too late resulting in drainage, beginning cell collapse and undesirable gradients in foam density and overall heterogeneity. We have developed a new epoxy foam based on an anhydride cure, which generally has slower kinetics than an amine-cured system. We use the decomposition of di-tert-butyl dicarbonate as a blowing agent. Additional gas generation and an early gelation reaction to enhance the foam stability is provided by polymeric isocyanates. We examine the cure and foaming kinetics with IR spectroscopy and volume vs. time measurements. We also use rheological measurements to correlate cell stability with relaxation and visco-elastic behavior under stress and chemical cure conversion. Finally, processing studies and x-ray tomography are used to assess the processability and quality of the final foam after filling a complex geometry. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the United States Department of Energy's National Nuclear Security Administration under Contract DE-AC04-94AL85000.