

MICROWAVE AND CONVENTIONAL MECHANICAL & THERMAL ANALYSIS OF THE REACTIONS IN EPOXY VINYL ESTER RESINS

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ABSTRACT

Over a billion microwave ovens are used every day thus witnessing the importance of microwave heating in the world today. Microwave processing of polymers is a comparatively recent and vastly expanding field in industry due to economical advantages through energy saving and accelerated manufacture. Factors that hinder the use of microwaves in materials processing are decreasing every day.

Epoxy vinyl ester resins represent a compromise between the comparatively cheap polyester resins and epoxy resins which are much more expensive but also have much better properties. This type of resin is frequently used as the matrix in glass fibre reinforced composites

A microwave-heated TM 010 cavity has been developed which allows the preparation of coupons of the cured resin under well-controlled conditions. Computer modelling shows that sample is uniformly heated in the centre of the cavity. The cavity is heated through a solid-state 200W amplifier at a frequency of 2.45 GHz. The temperature of the sample is recorded using a fluoroptic probe. Through a computer controlled feedback loop the power of the microwaves is adjusted in order to maintain optimum heating at set rate. Mechanical testing of DMTA and tensile testing of the coupons was carried out to compare the microwave and conventionally cured systems.

A microwave-heated calorimeter, similar to a differential scanning calorimeter, has been used to compare the reaction rate and processes in conventional and microwave heating. Comparative studies of the conventional and microwave DSC for the epoxy vinyl ester at different heating rates (5,8,10 and 12 °C /min) apparently showed enhanced reaction rate at lower temperatures in the microwave field compared to conventional heating.