

MICROWAVE TECHNIQUES FOR THE PREPARATION OF POLYMER FOAMS

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Polymer foams are often made by decomposition of a blowing agent in a large oven. The decomposition leads to the formation of a large amount of gas that in term blows the cellular structure of the material. This process has inherent drawbacks. Polymers usually have lower thermal conductivities than metals or ceramics. Heat transfer through the materials is thus slow leading to an uneven cellular structure. Furthermore as the structure of the foam forms the thermal conductivity of the material is further severely reduced. Often the air temperature around the foam to ensure expansion in the middle is so high that the surfaces of the material are thermally degraded.

Microwave heating with its volumetric nature offers a way around this. The penetration of he microwaves does not depend upon the thermal conductivity. Initial simple experiments showed that polyethylene/ ethylene vinyl acetate blends foamed when heated in a small microwave cavity. An outer layer of unfoamed material was left due to the contact with ambient air and also because the microwave field was concentrated into a smaller area than the volume of the expanded sample.

A microwave heating system has been devised with a large multimode cavity together with hot air heating. Fully expanded samples have been manufactured with this apparatus. The structure and properties of these foams will be compared to those of conventionally manufactured materials.