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KEY WORD : EXPANDED EVA / CELLULAR EVA / EVA FOAM / CROSSLINKED EVA FOAM

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The present work involved the study of the relationships between structures and properties of cellular rubber, in particular, cellular Ethylene Vinyl Acetate Copolymers (EVA) which was prepared by the single-stage compression moulding. The objective was to gain knowledge of the factors controlling the cellular structures and properties of expanded EVA. The applications of instrumental technique, including differential scanning calorimetry (DSC), thermomechanical analysis (TMA), thermogravimetric analysis (TGA) and oscillating disc rheometer (ODR), to control the foam production process were also studied.

The results obtained showed that DSC and TGA could be used to analyse the decomposition of the blowing agent (BA) including the activating efficiency of "activator" for decomposition of the BA. TMA could be used to study the foaming process of EVA at atmospheric pressure. Thus, the composition of EVA compound which produced stable foam could be determined by TMA. ODR could be utilised to characterise the crosslinking (curing) and gas blowing process of EVA compounds. Therefore, the controls of crosslinking of EVA in relation to the decomposition of BA could be carried out with the aid of ODR.

Several activators for the decomposition of BA were studied for their efficiencies. Zinc oxide (active) was found to be the most effective for the decomposition of azodicarbonamide (AZD) and was used throughout the present study for the production of expanded EVA.

For the studies of factors affecting the structures and properties of expanded EVA, the decomposition time of BA with respect to the cure time of EVA was found to be important. Large cell size and cell size distribution were obtained when gas was generated before EVA reached optimum cure (i.e. substantial extent of crosslinking occurred). If BA decomposed and generated gas at about the same time as, or after, the optimum crosslinking was reached, small cell size and cell size distribution resulted.

The physical properties of the foam were, however, not greatly affected by the difference in foam morphology. The density of the EVA foam was found to depend on the volume of the gas generated irrespective of the type of BA used. Therefore, it is possible that the density of expanded EVA can be predicted from the knowledge of the gas volume used. The cell morphology was also found to be controlled by the degree of crosslinking of EVA. Large extent of crosslinking tended to give EVA foam having smaller and more uniform cell size. The degree of crosslinking produced by peroxide cure could also be increased by the use of coagent with similar effect imparted on the cell morphology of the foam. The increase in crosslinking density effected by the use of coagent appeared to cause significant improvement in most physical properties of the foam. The use of small amount (e.g. 10 phr) of solid powder such as calcium carbonate or silica did not produce decisive benefits on the structures or properties of expanded EVA although a small reduction in the cell size and improvement in cell size uniformity were observed.