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INSITU ENHANCEMENT OF MELT STRENGTH BY MOLECULAR MODIFICATION OF POLYPROPYLENE IN FOAMING PROCESS

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The melt strength of polymers, at processing temperature, has a decisive role in applications where extensional flow dominates, such as blow moulding, thermoforming, and foaming. There is a certain range of viscosity wherein these processes can be carried out. If the viscosity is too high, it will not be possible to expand or extend the polymer. On the other hand, if the viscosity is too low, the foam or film will collapse immediately after forming. The molecular structure is known as the most effective parameter, on rheological behaviour of polymer melt. Herein, insitu Long-chain branches are incorporated into the molecular backbone of isotactic polypropylene (PP) in a foaming process and the effect of branching on melt properties and polymer foaming performance was investigated. The branching of polypropylene occurs by radical reactions of dicumyl peroxide and a tri-functional monomer, trimethylol propane trimethacrylate (TMPTMA) in melt state. The foaming process was also occurred by thermal decomposition of a chemical blowing agent (Azodicarbonamide) after strengthen of polypropylene melt, by mentioned chemical treatment at the same mould. Results of Melt flow index test, show use of peroxide without tri-functional monomer cause in scission of PP molecular chains and significant reduction in melt viscosity; while adding TMPTMA to formulations, enhances melt strength and expandability of polypropylene. 13C NMR confirmed presence of long chain branches in PP chain backbone after chemical modification. The prepared samples were also tested by DSC and results show that Melting temperature of PP remains unchanged with branching reactions, implying that reactions occur mainly in amorphous regions of polymer. In addition some of major properties of prepared foams, such as density, foam morphology, tensile behaviour, and compression strength were tested.