Melt Flow and Impact Behaviour of Composite Materials at Elevated Pressures

Abstract:

Using composite materials in industrial applications has grown rapidly due to their advantageous properties, such as high resistance and durability compared to their weight, making composite materials a viable alternative to metals in many applications. Thermoplastic composites were studied in this thesis, and the polycarbonate was used as a mold and support with different glass fiber ratios (10%, 20%, 30%). The impact of adding glass fibers on the mechanical properties of the samples was studied. The samples were obtained using the extrusion device and tested under high temperatures to observe the flow. A significant increase in flow was observed with increased pressure. Mathematical relations were developed to represent the stress-strain relations of the obtained composite samples. The relations obtained these mathematical constants. The time to failure relations for composite samples were studied, and the energy absorbed by the composite samples was improved. Adding glass fibers increased the time to failure and reduced the energy absorbed.

Name of the student: Abass Khalifa Aboljum
Supervisor: Dr. Abd al-Aziz Al-Ewaleed
Department: Chemical Engineering – College of Engineering
Master’s Degree – 2008
Abstract
The use of composite materials in industry applications has grown rapidly, owing to their favorable characteristics, including high strength and stiffness to weight ratios, composite materials have been considered replacement of metals in numerous structural applications. Thermoplastic composite was studied in this thesis where high density polyethylene is used as a matrix and reinforced with different percentages of fiber glass ranging from (10%, 20%, 30%). The influence of addition of fibreglass on mechanical and thermal properties was studied. A pilot plant extruder is used to prepare the needed samples, where experimental investigation is carried out to evaluate the melt flow and the impact behaviour of the melt mixture at high temperature in the extruder. The flow rate increased by increased pressure. A mathematical correlation was developed to represent the stress – strain correlations of the composites used in this work. The combined model would be able to predict the creep, relaxation and recovery of composite materials, the constants of the model was obtained in area where the retardation effect is dominating. Time to failure correlation with stress was studied for the prepared composite material and mathematical correlation is established. The energy absorbed at fracture is improved for the composite material leading to a considerable delay in failure phenomenon. When added fibreglass led to increase time to failure and decrease energy of fracture.