

DESIGN AND PROCESS SIMULATION OF LONG FIBER THERMOPLASTIC BATTERY BOX DOOR FOR MASS TRANSIT APPLICATION

U.K.Vaidya, K. Thattai Parthasarathy, J. Serrano, Selvum Pillay, George Husman
Department of Materials Science & Engineering
The University of Alabama at Birmingham
Birmingham, Alabama
Corresponding Author: uvaidya@uab.edu
205-934-9199

Polypropylene (PP) and nylon based long fiber thermoplastics (LFT) are used in automotive parts such as bumpers and underbody panels in the mass transit industry. Their advantages of high specific tensile properties, reduced weight, cost and recyclability have enabled them to replace metals. LFT's have thermoplastic matrix reinforced with long glass or carbon fibers (25 mm) and are processed to end products by the extrusion/compression molding process. The current work focuses on design, analysis and processing of a cost effective, low cycle time mass transit bus battery box door that replaces an existing metal frame door. The part was designed in Pro-Engineer® and modeled for stress analysis using ANSYS™. A considerable weight reduction of 60% using the LFT thermoplastic design was predicted over the current steel door design. CADpress for Thermoplastics® software was used to simulate the extrusion/compression molding processing of the LFT battery box door. The simulation is necessary to evaluate whether the part will fill with the extruded molten charge and to optimize process conditions (press force, temperature, shrinkage, warpage etc.) The simulation of the LFT charge during the molding process was conducted to evaluate the above mentioned parameters. The process modeling predicted the part filling, fiber distribution, preferential orientation, shrinkage and warpage, for different molding parameters such as temperature, pressure, and charge placement. A representative solid model of the battery box door is shown in Fig.1 and a typical flow simulation of the E-glass/polypropylene extruded charge through the compression molding cavity is shown in Fig. 2. The presentation will detail the design and process modeling efforts.

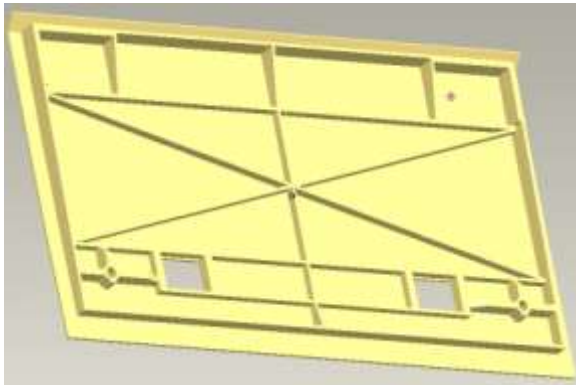


Figure: 1 Solid Model of Battery Door in Pro-Engineer

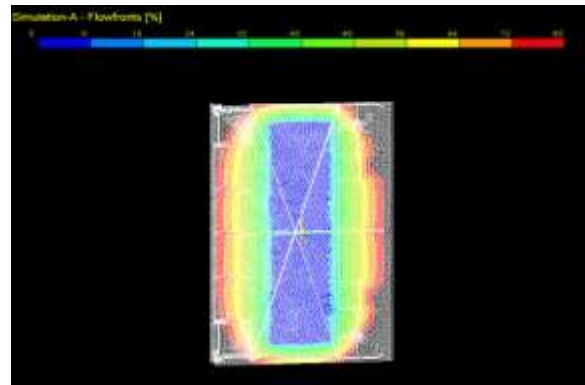


Figure: 2 Flow Simulation Model of Horizontal Charge in CADpress®