Prediction of Fiber Orientation in Compression Molded Parts of Short-Fiber-Reinforced Thermoplastics

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Short Fiber molded thermoplastics like poly ether ketone ketone (PEKK) have the potential to be used to build reinforcement structures for next generation air crafts. Because of the anisotropic properties of these fibers, it is necessary to know the orientation of fibers in molded parts to determine the strength of parts. The goal of the project is to prepare samples that will be used to determine the spatial distribution of fibers as a function of the parts thickness and for comparison with computer generated models to test for accuracy. Using a full factorial method the effects of four key control parameters, namely compression load, material dimension, incubation time and platen temperature, will be observed on a predetermined mold shape to determine an optimal manufacturing strategy to ensure larger scale production with minimum variability between the parts. Primary investigations have revealed a surprising adverse effect of incubation temperature on the filling of the part. The effect of other parameters has been as expected; increasing pressure and smaller material size promote better parts. However a more detailed study is needed to develop a sound understanding of the role of each parameter in the manufacturing process. The completed work hopes to address these problems and ensure that thermoplastics become a viable alternative for structural reinforcements.