

Investigation of the Processing Parameters of Functionally Graded Closed-Cell Bio-Compatible Cellular Materials

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The project is focused on fabricating and SEM (Scanning Electron Microscope) imaging of functionally graded closed-cell cellular materials. Polylactic acid (PLA) which is a bio-polymeric material will be fabricated in plate-like structures. The solid PLA sample is placed in a pressure vessel (PV) with high pressure supercritical (Sc)

CO₂ at room temperature. The time duration should be enough for ScCO₂ to diffuse and achieve a uniform concentration throughout the PLA sample. The ScCO₂ tends to diffuse out of the PLA sample due to concentration gradient compared to the atmosphere (adsorption). The desorption time (td) decides the thickness of the skin layer where no

ScCO₂ left compared to the internal layers. The PLA sample is then placed between two platens of different temperatures at which the minimum is above glass transition temperature (T_g). Cells' sizes will be grading smaller towards the lower temperature. The parameters to be optimized are the saturation pressure, td, and the annealing duration as they are the ones mostly affecting the resulted microstructure. The project is self-motivating once the SEM micrographs start linking process-parameters to the resulted microstructure guiding to a definite vision for macro-manufacturing scale.