

## Introduction

The use of new polymers for **thermoplastic composites** potentially offers an increase in performance combined with a decrease in cost. A thorough understanding of the production process is required to develop an **optimal processing** route for these novel thermoplastic composites.

## Process description

Thermoplastic resin needs to infiltrate into a dry fabric during the consolidation process of flat fabric reinforced composite plates. This is a complex process with various **interrelated phenomena**, as shown in figure 1.

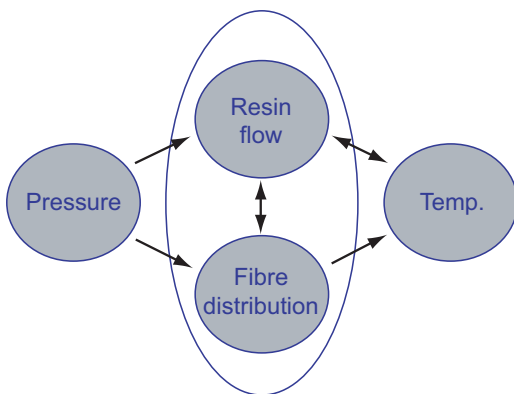


Figure 1: Relations between processing conditions and internal state of the laminate.

The applied pressure not only forces the matrix material to infiltrate into the fabric, but also alters the **infiltration kinetics** by deforming the **compliant**

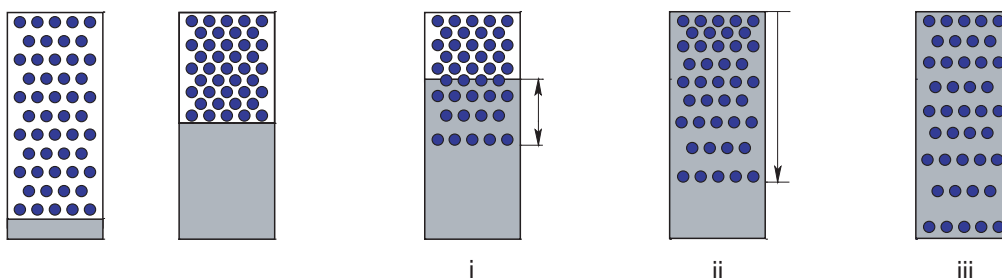


Figure 2: Schematic description of the preform impregnation process.

**fabric.** The process temperature significantly affects the **viscosity** of the plastic. Impregnation will improve at higher temperature, and conversely, heat transfer will improve as impregnation proceeds.

## Objectives

The first objective is an **improved understanding** of the phenomena involved and how they are related to each other. The second objective is the development of a **simplified impregnation model**. This design tool will shorten the time to market for new thermoplastic composite materials.

## Future work

Michaud and Manson [1] divide the consolidation process in three steps, shown in figure 2: (i) infiltration of the preform by the liquid polymer, (ii) preform relaxation and (iii) preform equilibration. The simplifying assumption of a **homogeneous permeability** will be replaced by an analysis at **meso level**, considering the flow around the fibre tows. A **Darcy flow solver** with fabric architecture as input will be developed.

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## References

1. Michaud V., Manson J.-A.E. (2000) Impregnation of compressible fiber mats with a thermoplastic resin. Part 1: Theory, *Journal of Composite Materials* 35/13, 1150-1173