DEVELOPMENT OF ADVANCED MULTIDIRECTIONAL COMPOSITES

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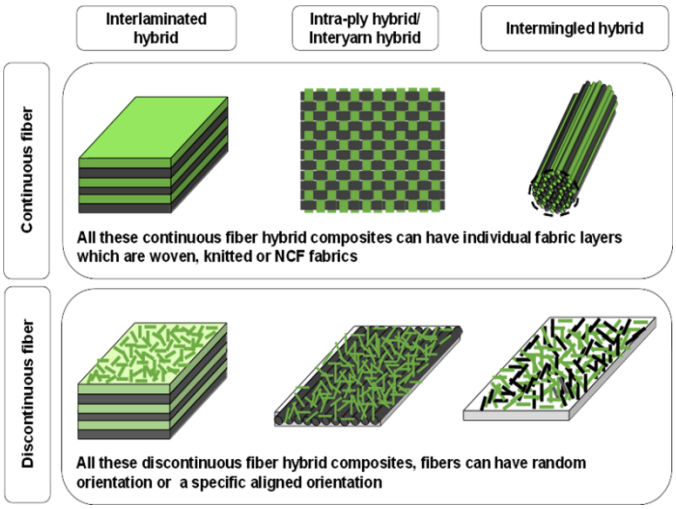

Figure: Hybrid composites - Levels of hybridization

Why Hybrid Composites?

- Limiting overdesigning of composites
- Increase in scope and area of utilization of composites
- Tailor-ability to specific loading conditions or property
- Better balance of several mechanical properties
- Possible cost and weight savings

Abstract:

Fiber reinforced polymer composites are finding increasing uses during the last four decades in high technology as well as conventional applications. Selection of the reinforcement materials for a typical application depends on various factors such as specific stiffness, specific strength, toughness, dimensional stability, corrosion resistance, weight and cost. A single reinforcement system in general does not fulfill all the favorable criterion for a typical application. Hybrid fiber reinforcement composites hence are the best solution for such applications. Using hybrid reinforcements is not a new topic among researchers, but in the current scenario where the applications of composites have been vastly widened, newer combinations of fibers and their fabric manufacturing processes are gaining lot of interests. The most important driving factors for most studies today including this PhD study are: limiting overdesigning of composites, increasing scope and area of utilization of composite materials, tailoring the design of composites for specific applications and possible saving in cost and weight.

The present thesis hence will include following novel studies:

- Studies on process of fiber spreading for glass rovings and comingled carbon/glass rovings which so far have not been used in the spreading process.

- Manufacturing and optimizing of non-crimp fabrics (NCF's) using hybrid reinforcements. Introduction of thin plies in hybrid composites is a very new concept.
- Analytical modeling of hybrid multidirectional composites to predict the stiffness of the composites
- Comparative study on type of hybridization; intra-layer, inter-layer and intermingled hybrids for the selected fiber combination and characterizing their mechanical properties those including tensile, flexural and impact behavior.
- Cost performance analysis for different fiber hybrids and their manufacturing processes.