

Polymer-Matrix Composites

"Make plastics competitive with steel"

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What are Composites?

Structures made of materials which maintain their identities even after the component is fully formed.

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Two Main Components

- ◆ **Matrix (or Resin)**- metal, ceramic, or polymer that surrounds the fiber
- ◆ **Reinforcing Fiber**- metal, ceramic, or polymer embedded in the composite

Polymer-Matrix Types

- ◆ **Polyesters-**

- ◆ Inexpensive and easy to process

- ◆ **Phenolic Resins-**

- ◆ For high temperature applications
- ◆ page 529

- ◆ **Epoxy Resins-**

- ◆ For high strength applications and creating smooth surfaces

Good Reinforcing Fibers

- ◆ High elastic modulus
- ◆ High strength
- ◆ Low density
- ◆ Easily wetted by the matrix

Fiber Layout Designs

- ◆ **Unidirectional-**
 - ◆ Fibers are all aligned (isostrain condition)
- ◆ **Biaxial-**
 - ◆ cross-ply orientation
- ◆ **Laminates-**
 - ◆ Two or more **unidirectional** composites joined together
- ◆ **Or any combination from above**

Manufacturing Processes

◆ **Sheet Molding-**

- ◆ Deposit resin on carrier film
- ◆ Deposit fiber on resin
- ◆ Add more resin on top with another layer of carrier film
- ◆ Smoosh through rollers

◆ **Bulk Molding-**

- ◆ Premix the polymer with the fiber
- ◆ Smoosh through rollers

◆ **Pultrusion-**

- ◆ Pull preheated **prepreg** through heated, tapered die

◆ **Open-mold-**

- ◆ spray-up
- ◆ tape laying machines
- ◆ filament winding

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Applications of Composites

- ◆ Building houses
- ◆ Sports equipment
- ◆ Vehicle drive shafts
- ◆ Structural members for vehicles and aircraft
- ◆ Boat hulls

Summary

- ◆ **Composites** are distinct materials which retain their identities after formation
- ◆ The **matrix** (or **resin**) surrounds the **fiber**
- ◆ A combination for almost any application
- ◆ Strength and elasticity can be easily calculated
- ◆ Houses can be built of composites

Credits

- ◆ Special Thanks To
 - ◆ American Structural Composites (ASC)
 - ◆ Speaker Don Cipriano
- ◆ Reference Material
 - ◆ Introduction to Manufacturing Processes
(CH15)

Questions??????????

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