IVE | Engineering 工程

SOPHIE SGOC

開啟淨零，可持續發展進程

「新能源新世代2024」
可載人太陽能車(大車) 工作坊四
車身設計大不同 及
碳纖椅子製作展示

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工作坊內容

01 1)初談高效節能設計
1月27日

02 車輛動力ABC
2月24日

03 電力驅動技術
3月16日

04 車身設計大不同
7月6日

05 太陽能車攻略
7月13日

主題

1) Technical submission example
2) General introduction
3) Basic knowledge about CFRP
4) Tools & Manufacturing Methods

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「新能源新世代2024」
可載人太陽能車(大車)
Technical Submission Form

Technical submission example

Submit pictures

Team details

Technical Submission form - New Energy New Generation 2024

INSTRUCTIONS

Team please complete the below table, and attach the pictures as the following highlighted link in green.

TEAM	Team name:		Energy:	
	Car name:		Form status:	Incomplete
	Pictures:		Pictures:	18 pics needed
	Design	Side Top Front Rear 3D Windows Mirrors	Date of submission:	
	Safety	Bulk head Wheel bulk head Roll bar Ventilation Brakes Safety belt	Version:	
	EV	Electric propulsion system Electrical schematic		

Article	Information	Status	Input	
A	**Technical submission details**			
	Submission date (dd/mmm/yyyy)	>		
	Version number (pervious version will be replaced)	>		Revision
B	**Team details**			
	Registration ID	>		
	Team name	>		
	Car name	>		
	School name	>		
	Energy type	>		
	Is it a hybrid vehicle (i.e. apply regenerative braking)?	>		
	Is the generated energy stored in a super capacitor?	>		
C	**Previous participation in New Energy New Generation(NENG) event**			
	Has this car been used in a previous event?	>		
	What was your race number?	v		
	What was the energy type?	v		
	Will you be making any changes to the car?	v		Changes

Instructions | Technical Submission form-Table | rev | dc | side | top | front | rear | 3D | window | mirror | bh | wheelbh | rb | vp | br | cg | sb | lug | to ...

Technical submission example

Input your car details

All the details are refer to the regulation, please double check with regulation when working

E	Car structure		
4.2.	**Car dimensions**		
4.2.1.	Height (mm)	>	
4.2.4.	Track width - front (mm)	>	
	Track width - rear (mm), if any	>	
4.2.2	Width (mm) [exlcuding mirrors]	>	
4.2.5.	Wheelbase (mm)	>	
4.2.3.	Length (mm)	>	
4.2.6.	Driver compartment height (mm)	>	
	Driver compartment width at shoulder (mm)	>	
4.2.7.	Ground clearnace (mm)	>	
4.2.8.	Car weight (kg)	>	
	Car design		
4.3.1.	Number of wheels	>	
4.13.3.	Wheel types	>	
4.3.8.	Sharp edges/objects outside or inside vehcile	>	
	Aerodynamic appendages (flaps that move with wind)	>	
	Sharp objects inside the vehicle	>	
4.13.	**Wheels and Axles**		
4.13.2.	Appropriate dimensions and fixing	>	
	Are the wheels isolated from driver with a bulkhead?	>	
4.13.	**Tyres**		
4.13.2.	Width of tyre (mm)	>	
4.13.2.	Tyre tread depth (mm)	>	
4.12.	**Vehicle handling and driver position**		
4.12.1	Steering is precise (no excessive play)	>	
4.12.2.	Turning radius (m)	>	

Instructions | Technical Submission form Table | rev | dc | side | top | front | rear | 3D | window | mirror | bh | wheelbh | rh | vp | br | sg | sb | lug | to

Technical submission example

Should match the electrical drawing, and provide in details

Scrutineers will check the electrical circuit on scrutineering based on the drawing provided

H	**Car Electrical systems**		
	Electrical safety		
	Maximum voltage at any point in electrical system	>	
4.17.1.	Maximum nominal voltage at any point in electrical system	>	
4.14.4.	All battereis and super capacitors short circuit protected?	>	
	Short circuit protection on +ve terminal of battery/super cap.	>	
	Electrical circuits protected against electrical overload?	>	
	All batteries & super capacitors outside driver compartment	>	
4.17.3.	Number of propulsion batteries	>	
	All primary sources are isolated from frame/chassis/accessory circuit	>	
	Solar system		
4.18.2.	Electrical circuit & proulsion system diagram/schematic provided	>	
4.20.1.	2 Labelled Joulemeters (for battery & motor)	>	
4.20.4.	Joulemeters inaccessible to driver	>	
4.20.5.	Joulemeters can be read easily from outside vehicle	>	
	Maximum current from the solar panels (amps)	>	
	Propulsion battery (primary source)		
4.17.3.	Number of propulsion batteries	>	
	Propulsion battery voltage - nominal (V)	>	
	Propulsion battery votlage - max. (V)	>	
3.2.3.2.	is it a lithium battery?	>	
	is a Battery Management System (BMS) installed?	>	
	Accessory battery		
	Used for emergency stop/horn/data logging system	>	
4.17.3.	Number of accessory battery	v	
	Maximum voltage of the battery (V)	v	
	Amp-hours of battery (Amp-hr)	v	
3.2.3.2.	Is it a lithium battery?	v	
	Is there a BMS for the battery	v	
	Enough electricity for safety devices (emergency shut, horn)	v	
	Accessory battery has grounded properly	v	

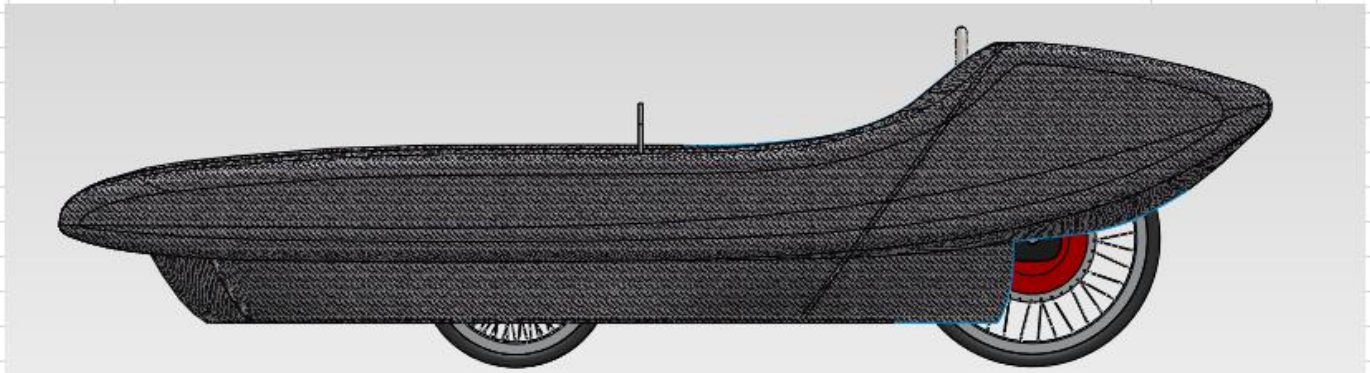
Technical submission example

Can submit the update version, but have to point out the update under “Design changes”

Home	Design changes
v2	insert more drawings
v3	insert photos of seat belt, mirror and brakes.
v4	update the electrical drawing
v5	add one more schematic on electrical circuit

Correct pic attached under the related sheets

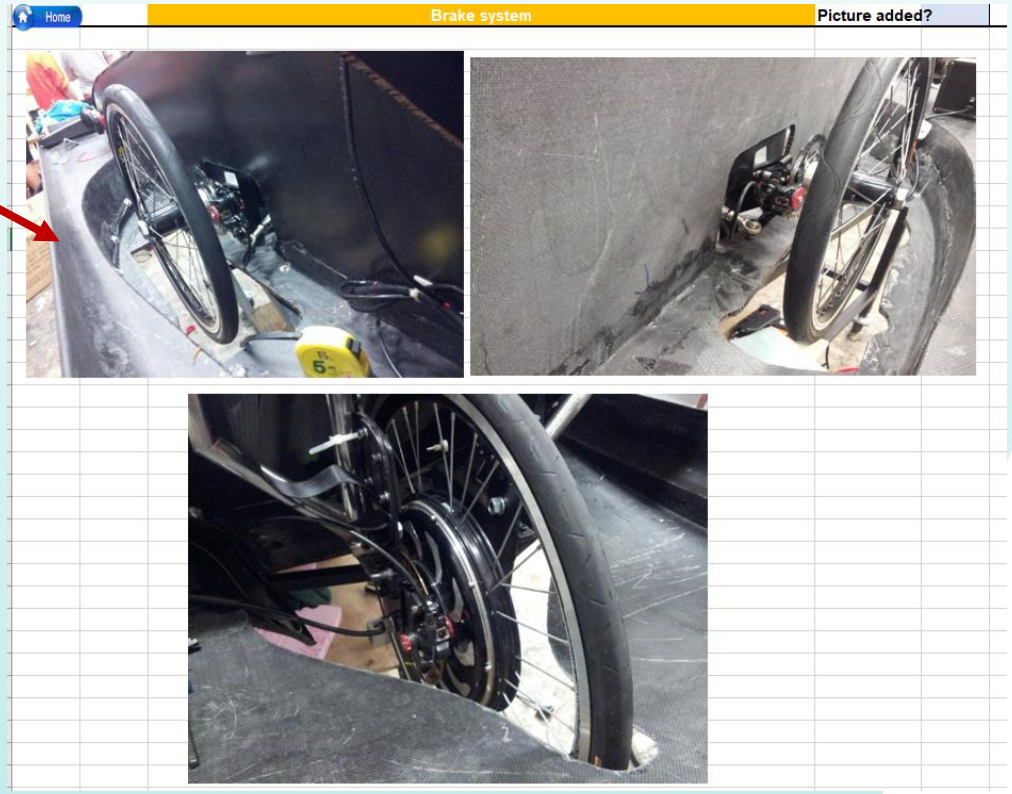
Home	Side view of vehicle	Picture added?



Technical submission example

Clearly point out the components, and provide the model

Compartment location

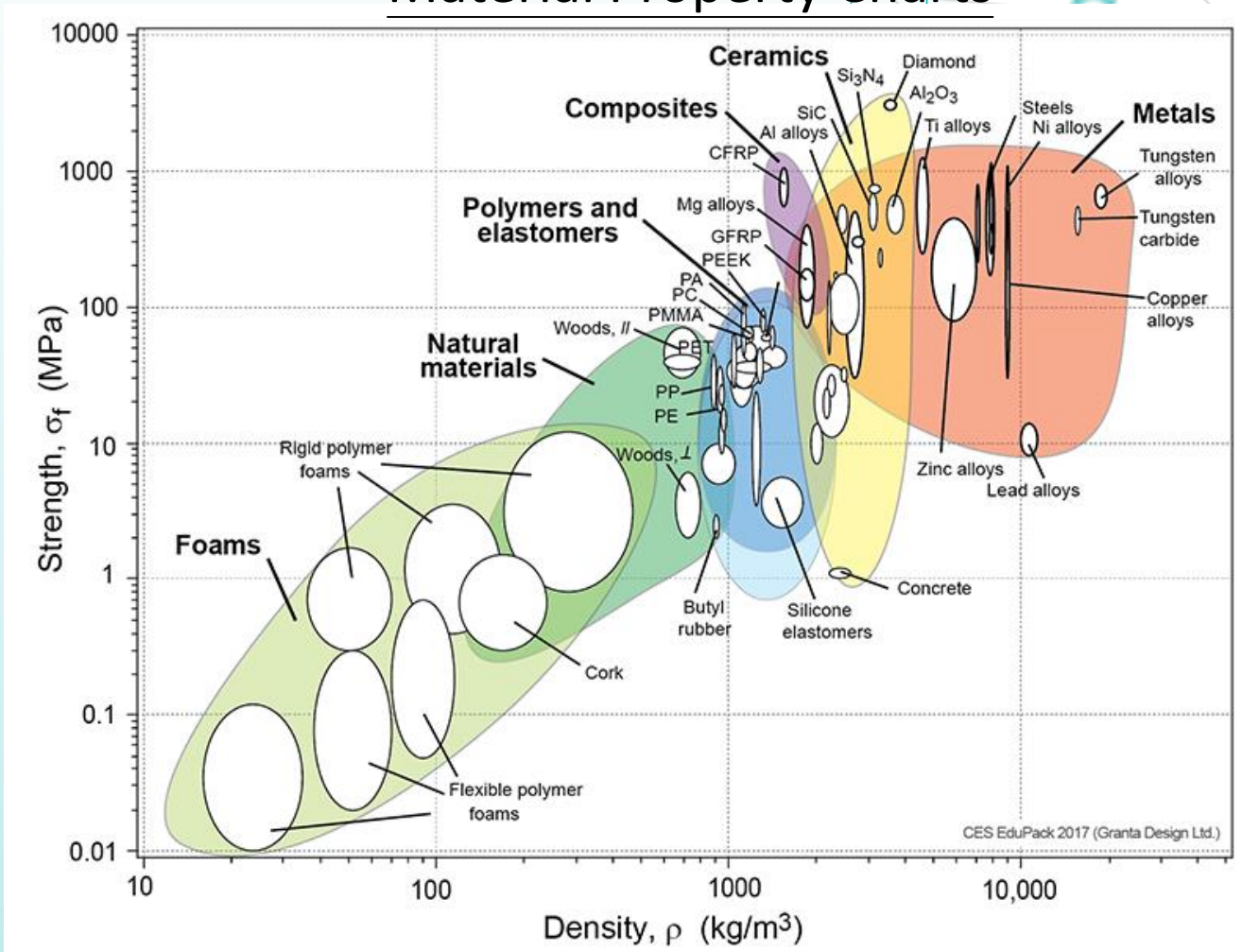


General introduction

- What are the major properties
  - Strength

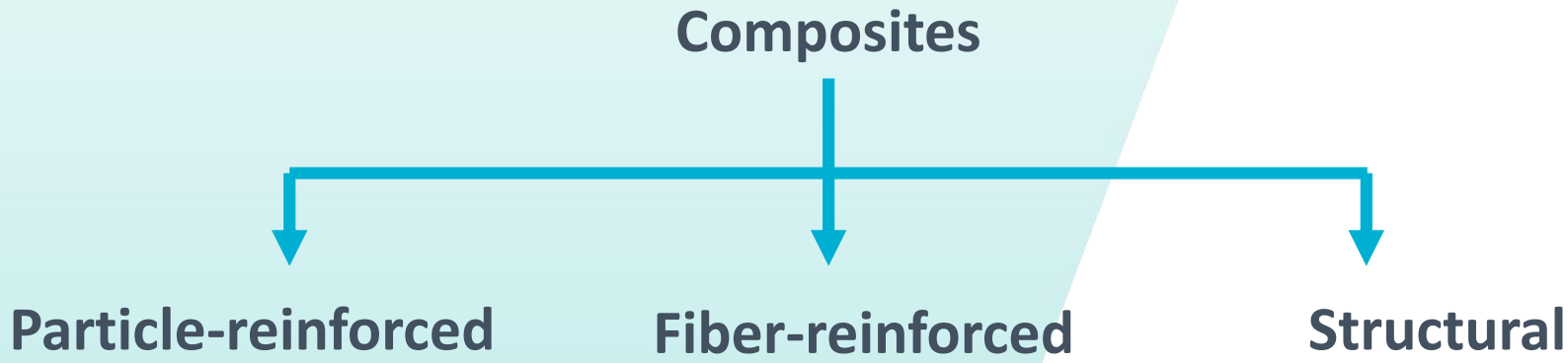
Think about: choose the material is strength enough for car body

Material Property Charts



General introduction

- What is composite?
  - Combination of two or more materials
  - Composite = matrix + fiber



General introduction

1.Combination of two or more materials : Composite = matrix + fiber

Polymer matrix composites or Fiber Reinforced Polymer (FRP)

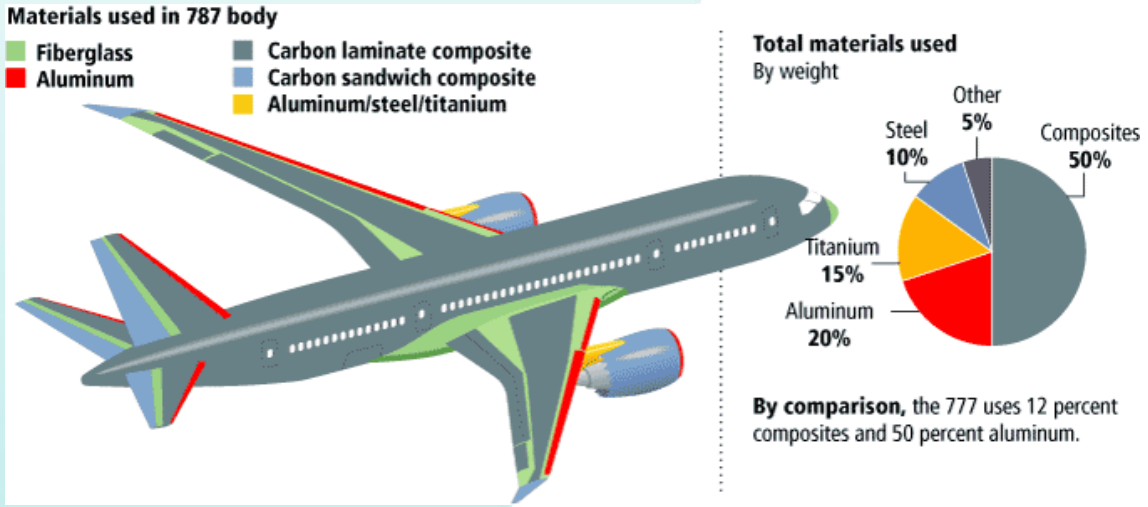
- Fibers generally glass, carbon, kevlar
- Matric can be: Epoxy, polyester

- Examples:
  GFRP aka fiberglass (polyester or epoxy and glass),
  CFRP (Polyester or Epoxy and carbon),
  KFRP (polyester or epoxy and Kevlar)

High strength and stiffness to weight ratio! Result in light-weight

Where are composites used?

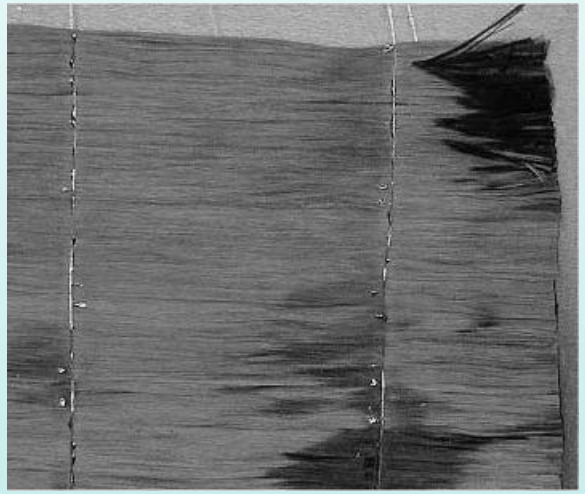
Example of using Carbon fiber reinforced composite:



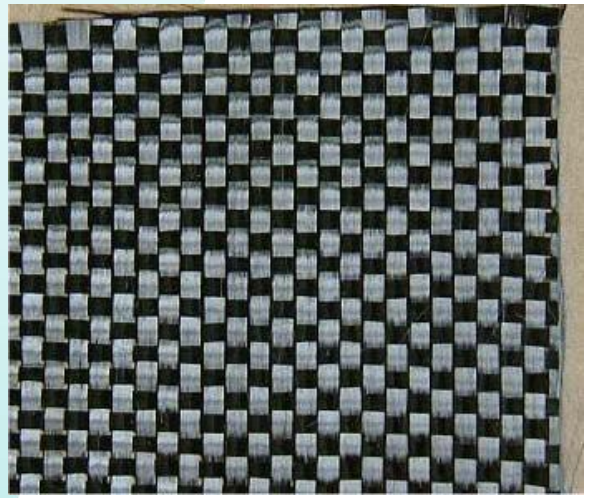
SOPHIE VI (left), Mountain bike: Volando - HT XC1(right top), Boeing 787 (right bottom)

Carbon fiber fabric

- Strength of carbon fiber fabric is eight times than steel
- Weight is 66% of aluminum
- No Corrosion



Unidirectional



Woven

Carbon fiber fabric

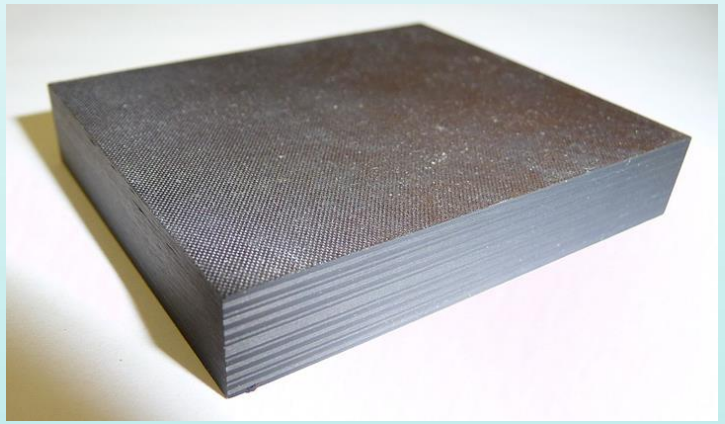
Type of carbon fiber fabric

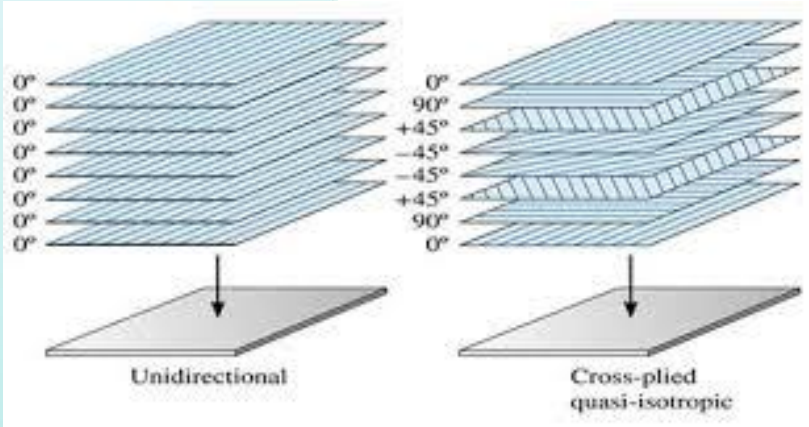
- Number of ‘K’
  - 1K, 3K, 6K, 12K
  - The number is the size of Carbon (1:most fine)

Structural composite

Laminate structure

- The layers are stacked and cemented together such that the orientation of the high-strength direction varies with each successive layer





Structural composite

Sandwich panels structure (1)

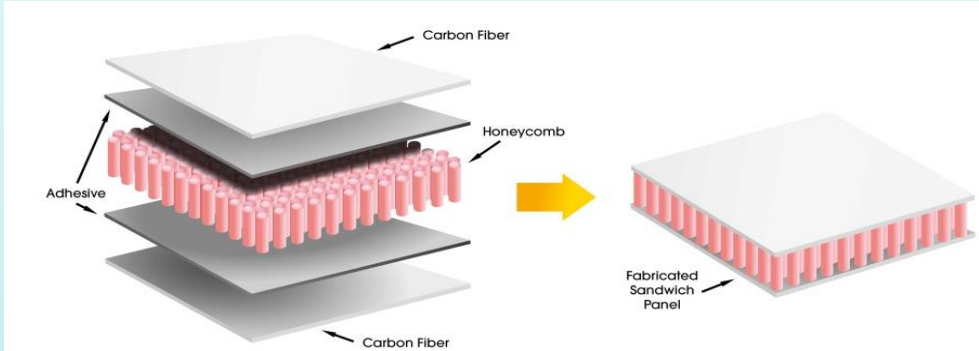
- 2 strong outer face sheets & core
- Face sheets carry most of the loading and stresses

Core has less density than the face sheets and resists perpendicular stresses and provides shear rigidity

Structural composite

Sandwich panels structure (2)

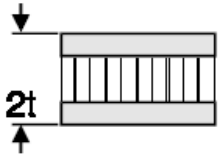
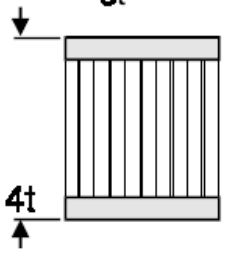
- Thickness increase by using core materials
- Increase the bending stiffness



CFRP sandwich structure

Structural composite

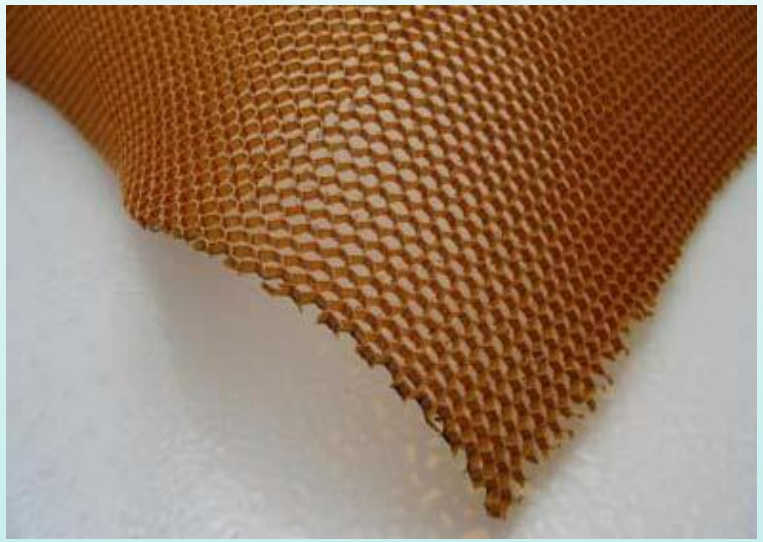
Sandwich panels structure (3)

	Solid Material	Core Thickness t	Core Thickness 3t
			
Stiffness	1.0	7.0	37.0
Flexural Strength	1.0	3.5	9.2
Weight	1.0	1.03	1.06

Core materials

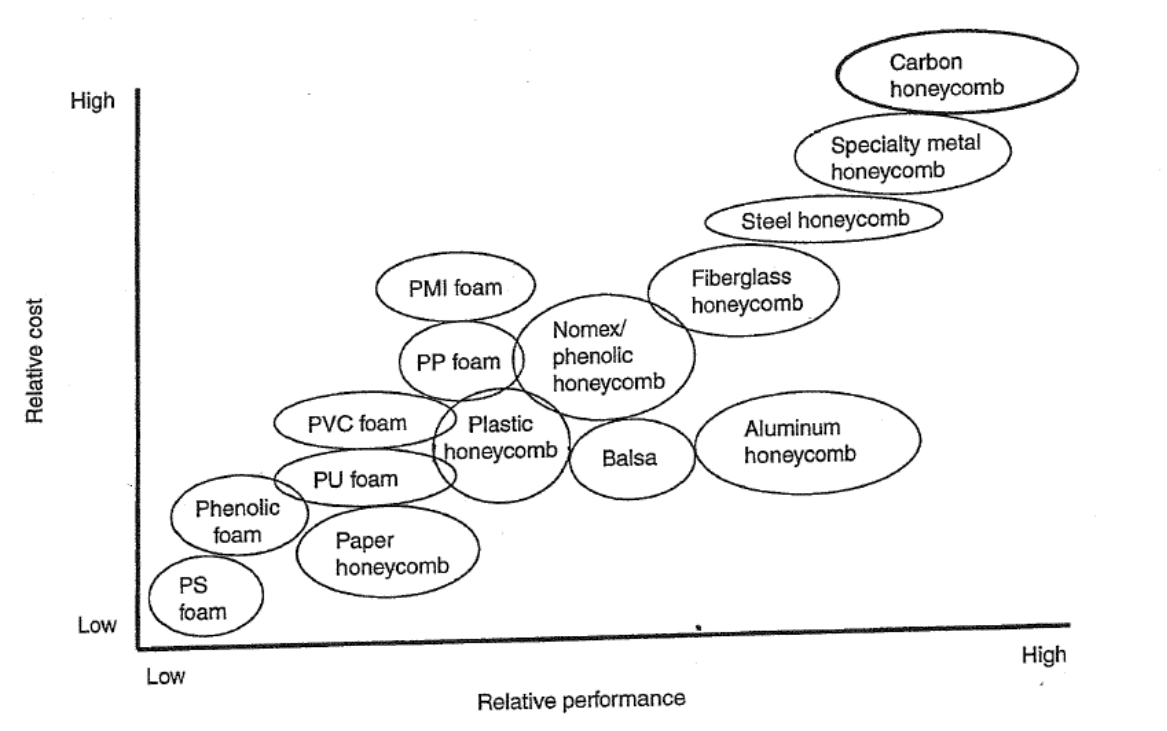
Most common core materials, include:

Honeycomb



Foam

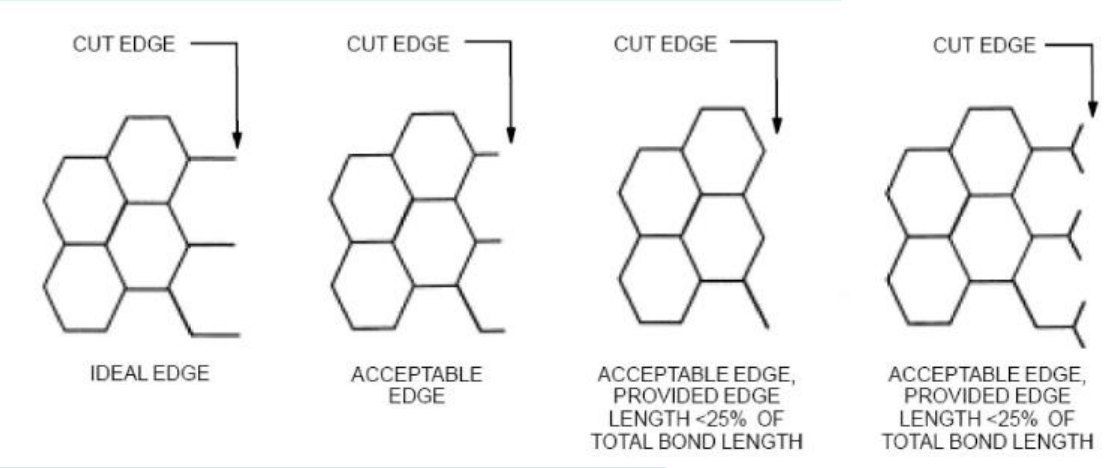
Core materials



Cost vs performance of various light weight structural cores.
PMI, polymethacrylimide; PP, polypropylene; PVC, polyvinyl chloride; PU, polyurethane; PS, polystyrene

Splicing

- Different areas of a structure with sandwich core may use different cores.
- Splicing is used to locally change the core to one with different properties, or attach smaller pieces of core into a larger piece.

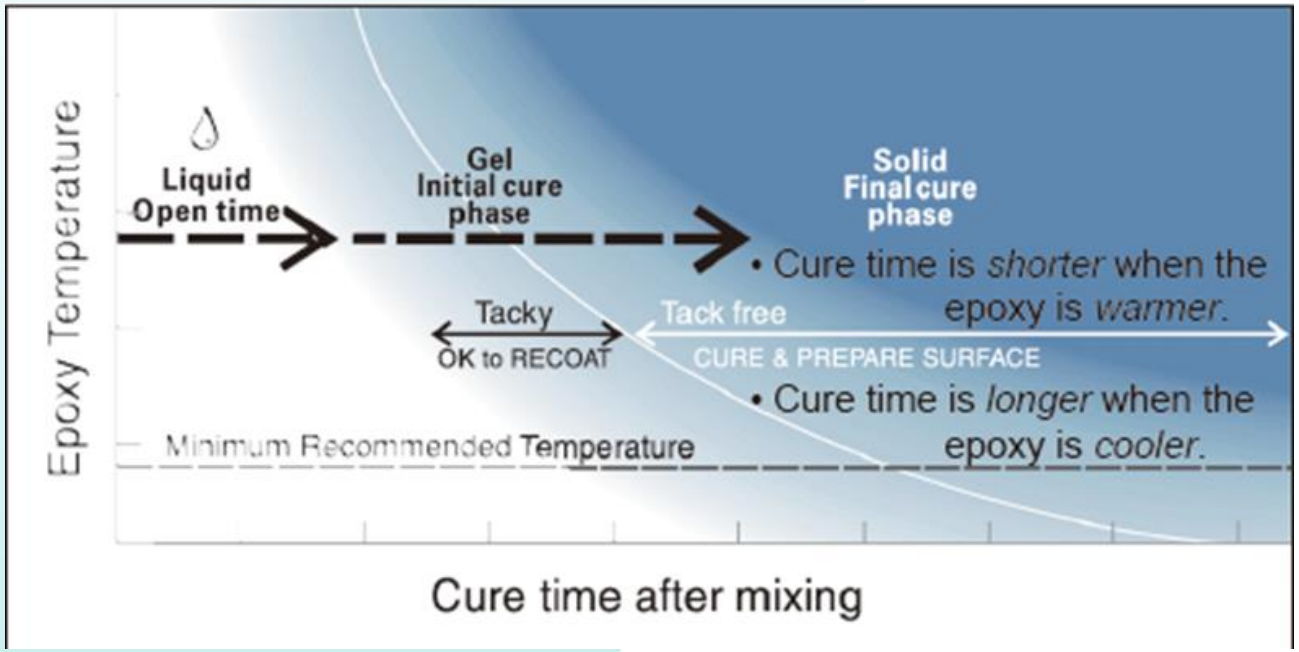


Honeycomb cut edges to be spliced

Epoxy

- Resin + Hardener
- Mixing ratio
- Curing temperature
- Bonding strength

*Read the guideline of epoxy from factory



As it cures, mixed epoxy passes from a liquid state, through a gel state, to a solid state.

Tools

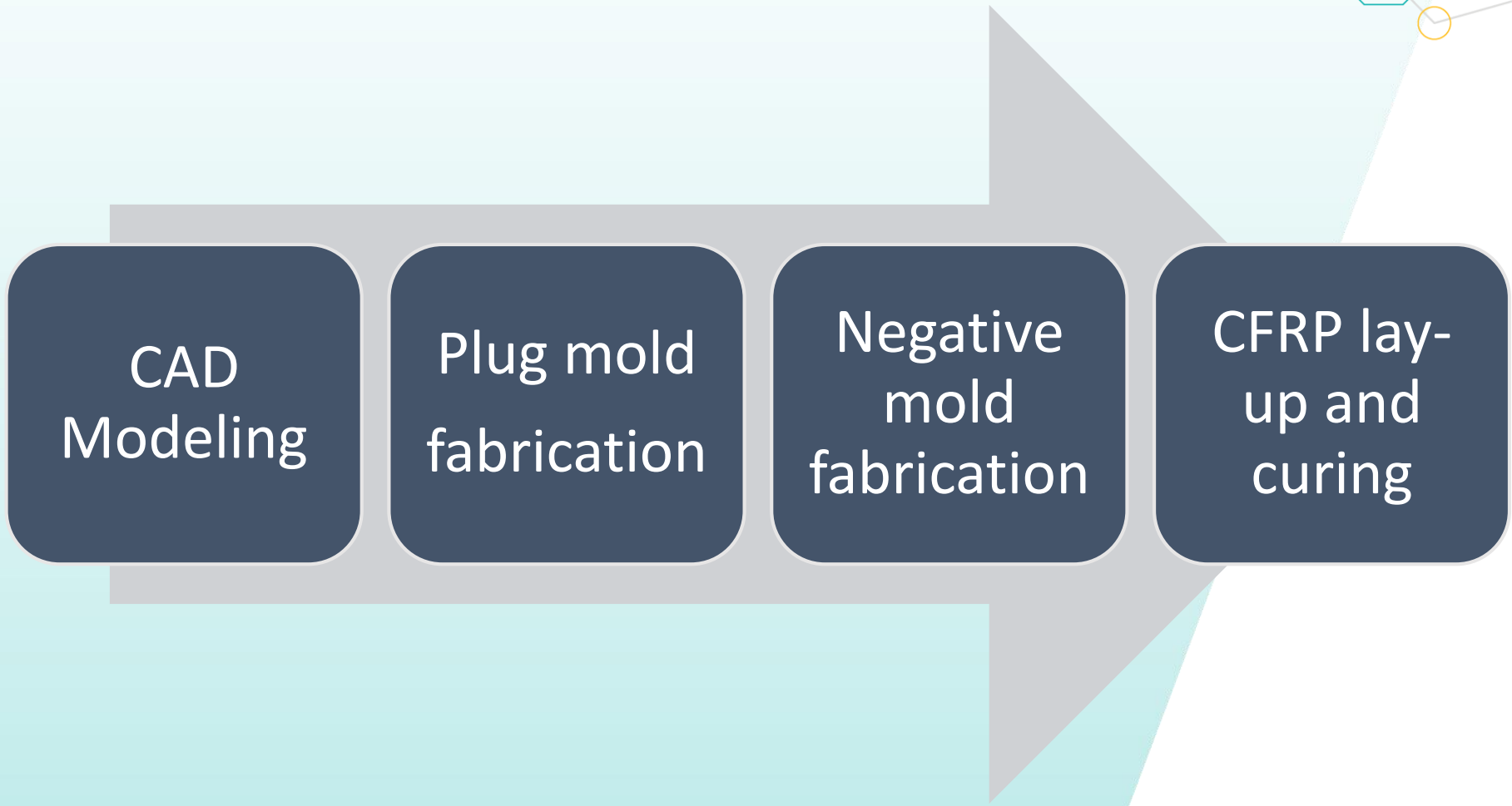
- Why using pneumatic tools?
  - Cutting speed ~ 20000 rpm
  - Preventing the delamination

Hand drill

Oscillating saw

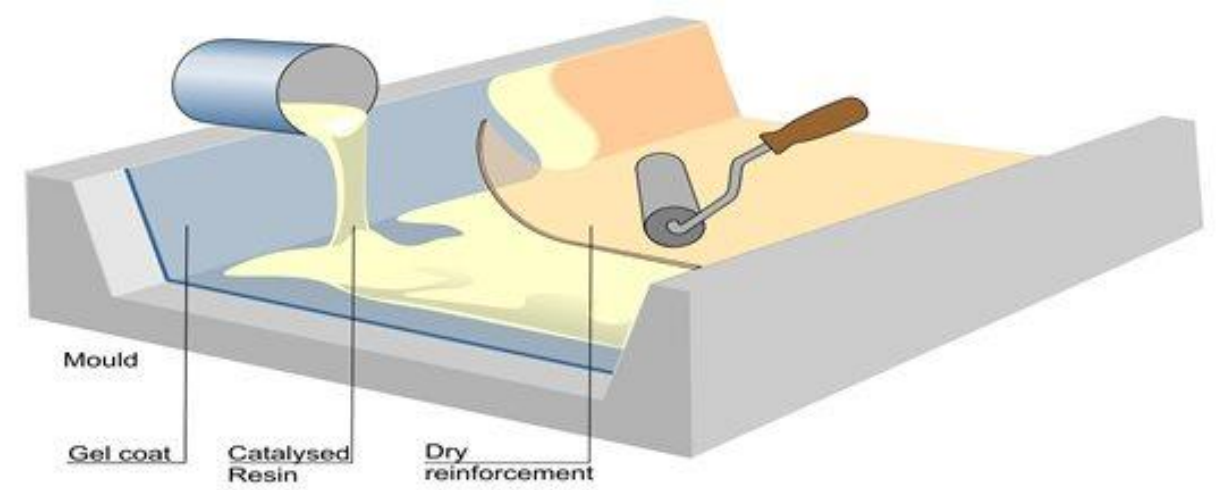
Jig saw

Procedure


CAD Modeling
Plug mold fabrication
Negative mold fabrication
CFRP lay-up and curing

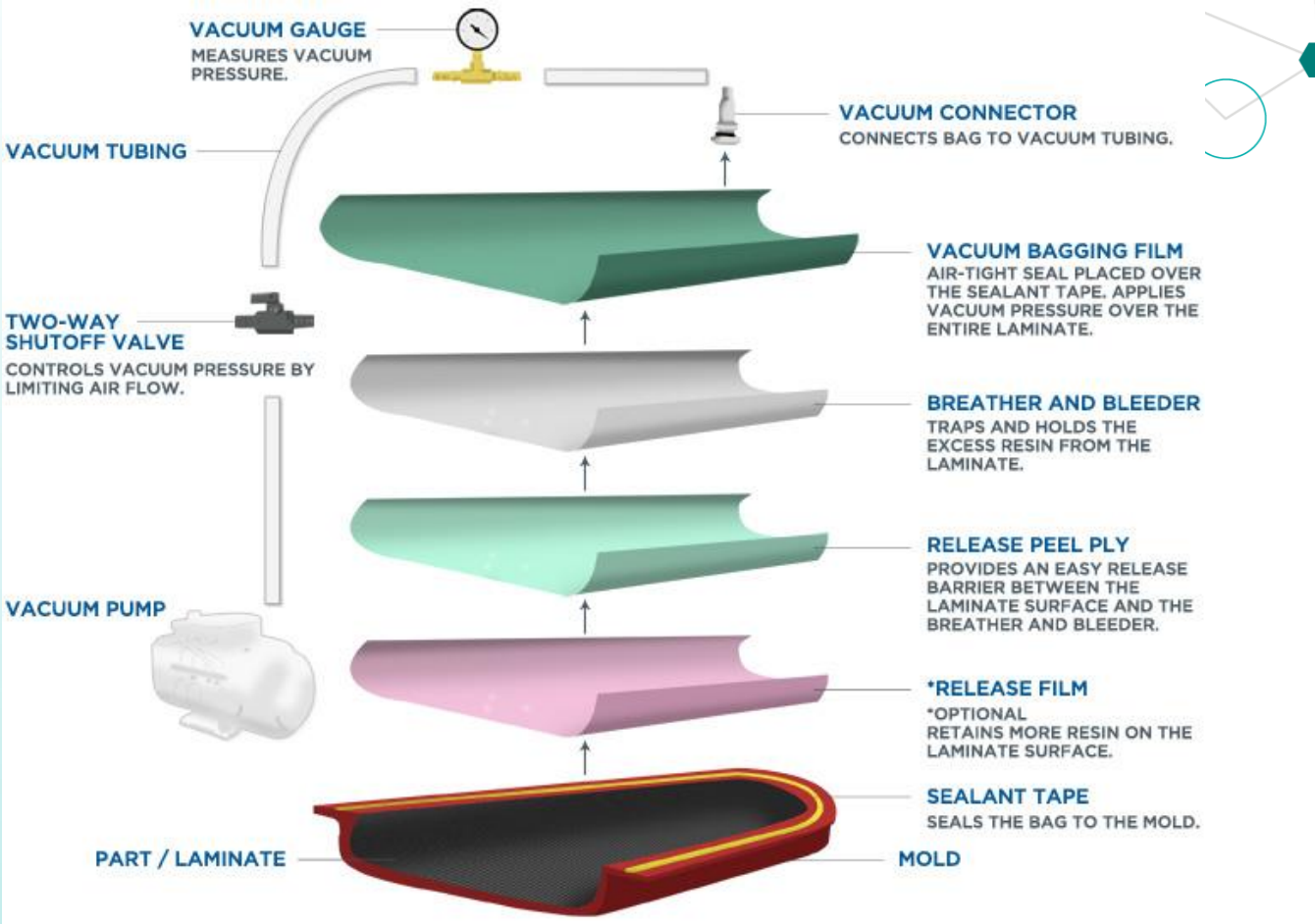
Procedure

- Open mold – hand lay-up



Procedure

- Closed mold – vacuum bag



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Procedure

- Prepare all the materials before start
  - Carbon fiber
  - Honeycomb
  - Nylon, Cotton
  - Plastic bag, yellow tack
  - vacuum pump
  - Epoxy, Gel coat, tools
- Ensure the production process
- Different members have duties

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