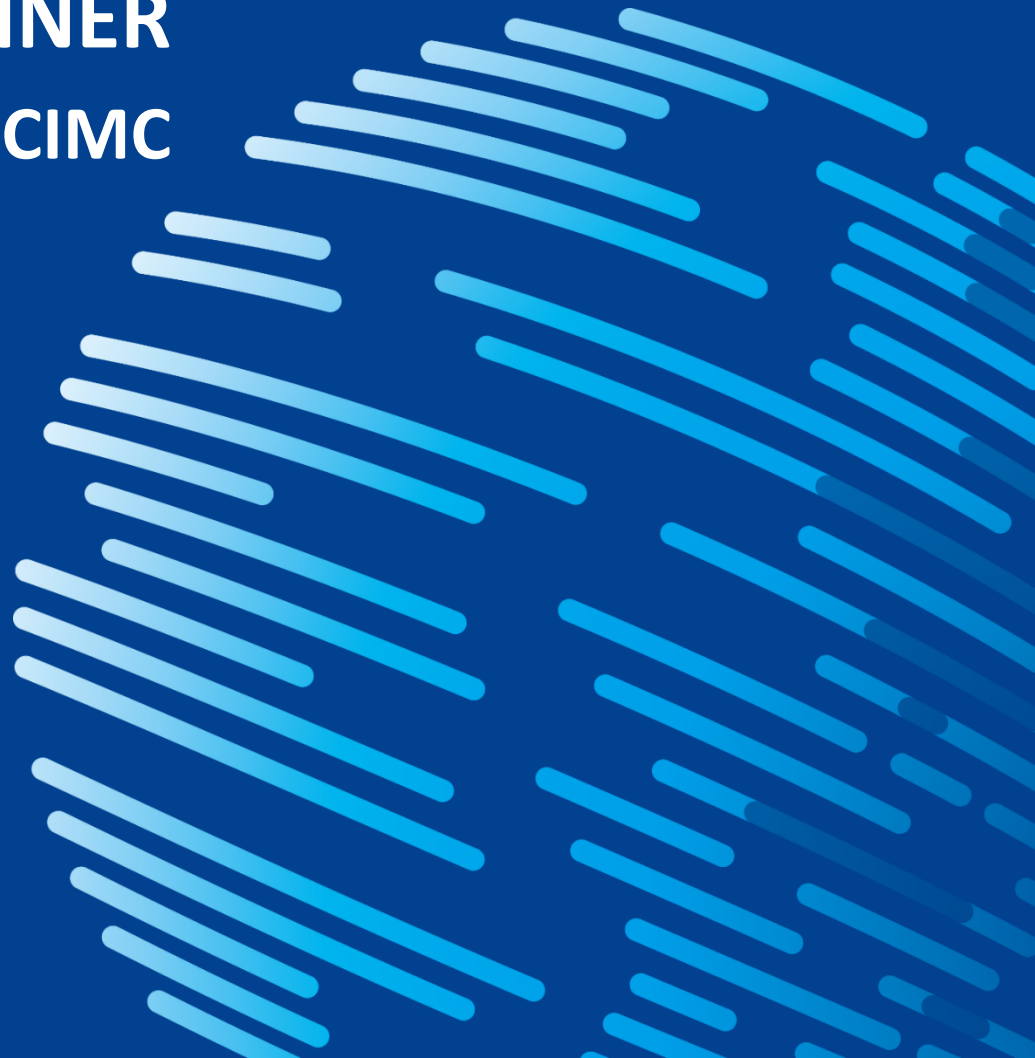
CIMC CONTAINERS

WE, CIMC CHANGE THE CONTAINER

-innovations in CIMC



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Main innovations in CIMC

- **CIMC Containers company profile**

- CIMC Containers (Group) Co., Ltd. (referred to as CIMC Containers) is a wholly-owned subsidiary of CIMC Group, headquartered in Guangdong, China.
- Company’s core business is container design and manufacturing. Our company has all serials of container products with independent intellectual property rights, and manufacture bases cover major coastal and inland ports in China.
- Since 1996, CIMC's container business has been global leading in production and sales, and our products cover major logistics systems in North America, Europe, Asia, and other parts of the world.

CIMC Containers Headquarter

Manufacture bases layout in China

Main innovations in CIMC

CIMC CONTAINERS

- **Engineer culture in CIMC**

➢ There are more than **2,186** engineers in CIMC Containers company, including **693** product engineers and **1,232** manufacture engineers.

➢ In decades, CIMC engineers have taken the lead in researching and applying waterborne paint instead of solventborne paint in the container industry, researching new bamboo-wood floor instead of tropical hardwood floor, creating digital/intelligent factories, pushing the industry towards automation, intelligence, digitization, safety, health, environmental-friendliness.

➢ They have made important achievements and will continue to lead the transformation and upgrading of the industry.

Tao Renzhong

Expert in container floor technology, led the researching of new bamboo-wood hybrid floor,and promoting the floorboard in container industry.

Pan Zuo

Expert in container paint technology, promoting the application of waterborne paint in container industry.

Jinping Hu

Director of Product and Technology Department, promoting the application of composite materials in container.

Li Ying

Expert in composite material product design.

Main innovations in CIMC

- **New material applied in container**

➢ **Bamboo-wood hybrid floor**

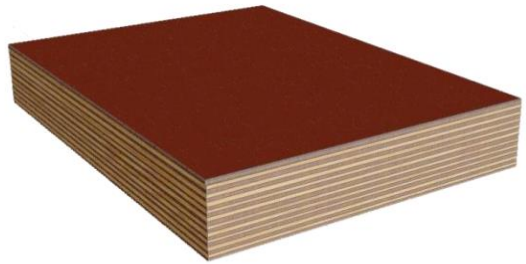
In decades, with the decreasing global supply of tropical hardwood resources, It was urgent for the container floor to change from hardwood to other sustainable resource.

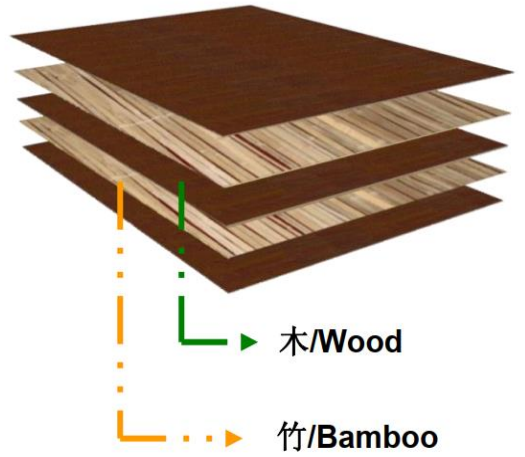
CIMC researched “bamboo-wood hybrid floor" to replace tropical hardwood, and won the second prize of National Science and Technology Progress Award in 2012.

The bamboo-wood hybrid floor’s main material is rapid regenerated bamboo and it is very sufficent and enviroment-friendly.

Compared to hardwood floor, the bamboo-wood hybrid floor can reduce VOCs emission about **0.58 kg** per TEU. For 3 million TEU, the VOC reduction is about **1740 ton**.

Now bamboo-wood hybrid floor has become the prevailing floorboard in the whole industry already.





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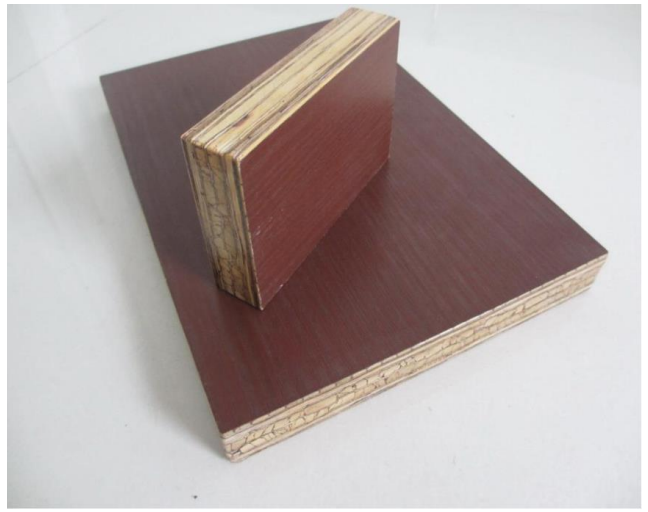
/ =Long grain veneer

- =Short grain veneer

Bamboo-wood hybrid floor layout



Bamboo-wood hybrid floor

Main innovations in CIMC

- **New material applied in container**

➢ **CFRTP reinforced floor**

CIMC researched one new bamboo-wood hybrid floor with top and/or bottom surface coated CFRTP skin, which improves its strength, wear-resistance and corrosion-resistance significantly.

If both top and bottom coated CFRTP skin, it has **28%** strength increased per our floor strength tests and simulation analysis.

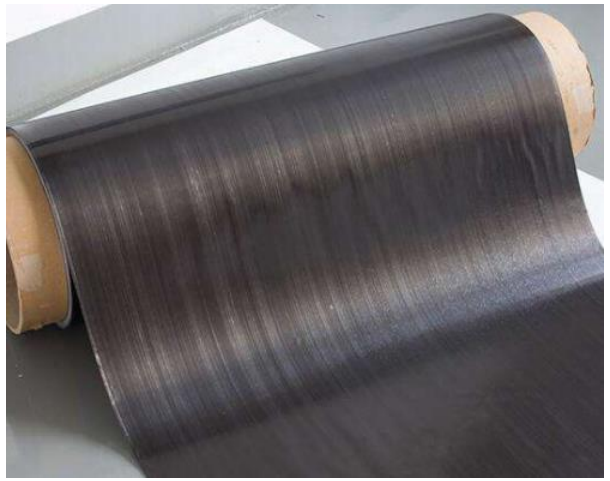
This type of floorboard has main advantages of:

✓ **Better durability:** oil-proof, corrosion-resistant and wear-resistance.

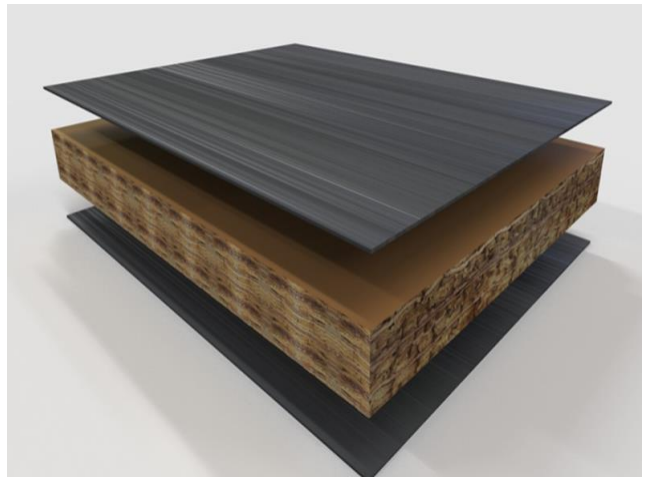
✓ **High stability:** Strength is better than tropical hardwood.

✓ **Environment friendly:** CFRTP skin can cancel the PU coating on floorboard.

✓ **Cost efficient:** CFRTP skin reinforced floorboard can offer a longer warranty period and reduce the M&R costs.

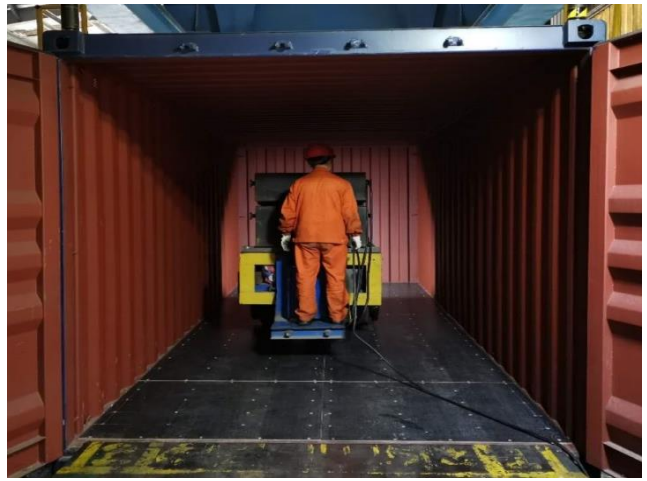


CFRTP film



CFRTP reinforced floor layout

CFRTP reinforced floor



Floor strength test

Main innovations in CIMC

- **New technology applied in container**

➢ **Waterborne paint**

In 2017, facing the challenge of healthy and sustainable development in the industry, CIMC took the lead in launching the initiative of replacing solventborne paint with waterborne paint in the industry.

Waterborne paint can effectively reduce VOCs emissions during coating.

Compared with the solventborne container, waterborne paint products achieve a **70.5%** reduction in VOCs emission per TEU. The waterborne paint container has become the prevailing container in the whole industry.

Waterborne paint container

Main innovations in CIMC

- **New technology applied in container**

➢ **Powder paint**

In 2019, CIMC built a powder paint production line at Xinhui factory, which can achieve zero emissions of wasted gas, wasted water, and waste residues during the paint spraying process. By now, more than 30,000TEU containers with powder paint have been produced and delivered.

The powder paint has **better surface performance**, **stable quality** and **enviroment-friendly**.

Compared to waterborne paint container, it can reduce:

VOCs emission by **4.74** kg per TEU.

Wasted water by **234** kg per TEU.

Wasted residues by **17** kg per TEU.

Powder paint container

Main innovations in CIMC

- **New design in container**

➢ **Rust-free Panel**

At present, CIMC is researching and developing a specialty container to reduce the use of steel panels as much as possible.

The special panel has the characteristics of rust free, odorless, easy to clean, and low maintenance costs.

Also, The rust-free panel container can reduce the welding, painting work during the manufacture process.

Continue….upcoming speech by our engineer about this specialty container.

CONTENT

Rust-free Panel

- **Challenges of steel Panel**

Based on on-site survey, customer feedback, and information collected by CIMC, steel panels are facing these challenges:

- Steel panels are prone to rusting and even corrosion penetration, making container unsuitable for loading and increasing M&R costs for customers.
- For the newly built container, smell cannot be immediately got rid of, risk of contamination to goods such as food and medicine.

Rust outside container

Rust inside container

Rust-free Panel

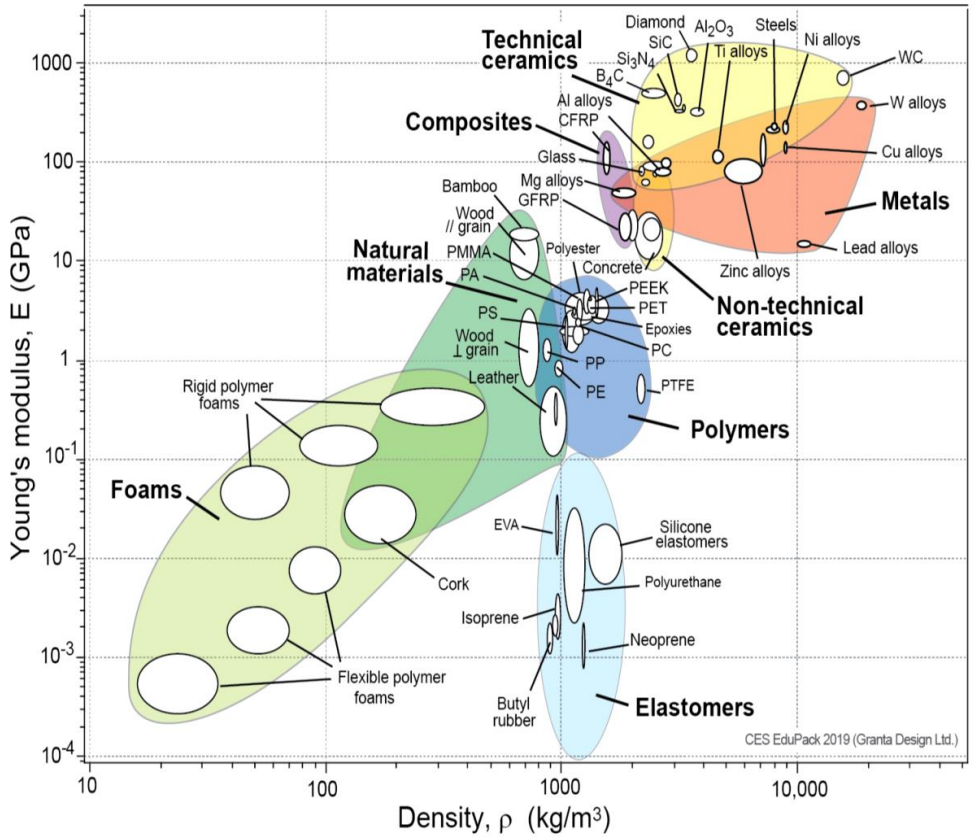
Material selection

After about 4 years' research on technical features with capacity and cost of material, finally the CFRTP comes to our stage.

CFRTP (Continuous Fiber Reinforced Thermo-Plastic) composites present significant advantages over the metal in multiple aspects

- High stiffness
- Very high strength
- High lightweight construction potential thanks to low density
- Excellent design flexibility
- Recyclable
- Very good energy absorption properties
- Low coefficient of thermal expansion
- Good dimensional stability and chemical and corrosion resistance

*****PP inside layers and PET surface film with continuous glass fiber is one of our selected in our research.**



CFRTP can meet the core requirements of **replacing steel with plastic, recyclable, low-carbon, high stiffness, high strength, and lightweight** in various fields

Rust-free Panel

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- **Lab tests**

Since December 2021, the rust-free panels container structure design simulation and total 9 sample tests of rust-free panels have been carried out, including impact resistance, bonding+riveting test, roof simulation test, wall-airbag simulation test, water-tightness test.

➢ **Strength & rigidity test**

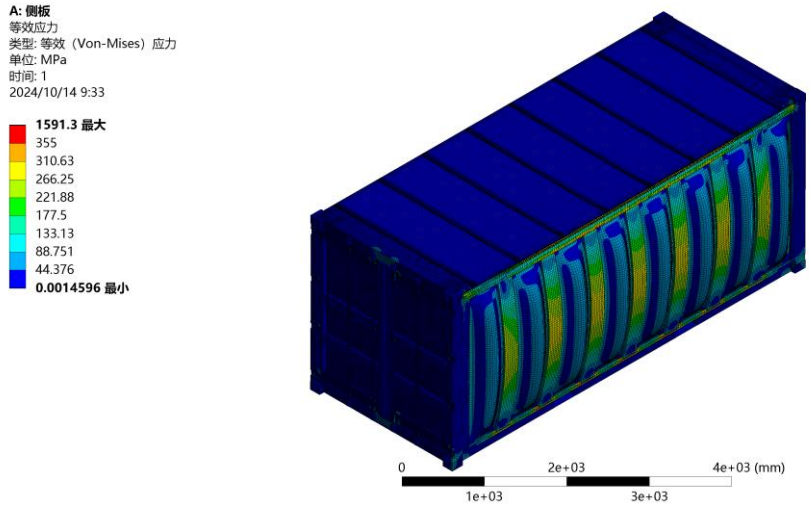
Simulation and test results show that the composite material has high strength, good wear resistance, excellent impact resistance and etc.

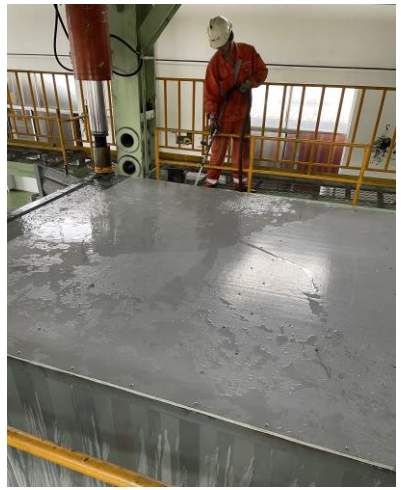
➢ **Rivet/Glue connection test**

After sample and container load test,we select Hem-Fix Rivet and Embedded Rivet and structure glue as the connecting method in composite container.

➢ **Water-tightness test**

After sample test, the water-tightness can meet technical requirements.





Rust-free Panel container

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- **Prototype tests**

The prototype container has a steel frame structure with rust-free panels, the rust-free panels are fixed by rivets and structure glue and passed all ISO tests with certificates issued by Classification Societies.

Inside wall directly contacts the goods, and is **rust free**, odor free, flat and easy to clean.

The rivets are hidden in the structure to keep a better water-tightness performance.

Compared to steel container in waterborne paint per TEU:

Tare weight: **210kg** ↓

Carbon emission: **900kg** CO_2 ↓

CERTIFICAT D'AGREMENT DE TYPE TYPE APPROVAL CERTIFICATE

N°BVCT 2483836/S

Rust-free Panel container

- **Load tests**

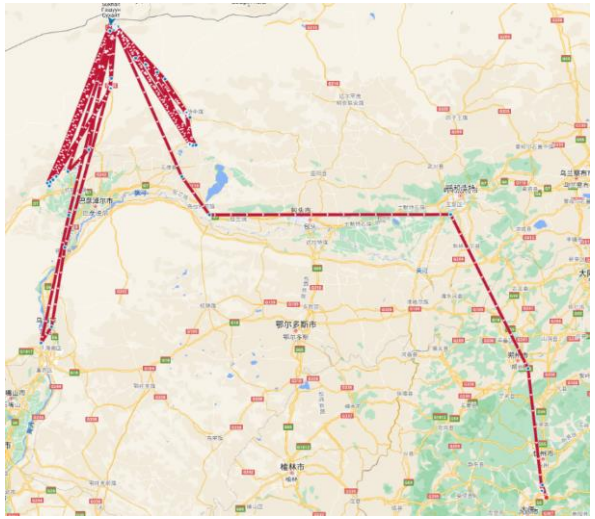
Until now, we have manufactured total 19 prototype containers and carried out about 4 load tests under various environments.

- ➢ Inland load test
- ➢ Offshore load test

These containers were loaded with different cargos such as coal, gravel, steel scrap and etc.

After on-site survey, all the load tests show the rust-free panel containers performed much better than steel container in rust, impact and deformation.

All are in good condition, with no any rivets found dropped off or loosen, or any water-tightness problems.



Inland/Offshore load tests

Rust-free Panel Container

- **Intermodal test**

From May 2024 until now, there are 12 unit ISO 20GP rust-free panel container put into the intermodal test by Cosco Shipping. The voyages are over all the world, and will last for about 1.5 years.

This test is carried by IPPC, with main purpose is to verify Bio-security container design.We have on-site inspection some times, all these containers are under normal marine use.

In September 2024, CIMC & MAERSK Line reached an agreement that CIMC will deliver total 30 units of rust-free panel container for MAERSK for batch intermodal transportation all over the world.

One of these containers is exhibited in our stand H20, you are warmly welcomed to have a physical look.

Rust-free Panel Container

- **Benefits of rust-free panel containers**

➢ **Rust free**

Rust-free panels are **rust free**, odor free, easy to clean and better in bearing wear, corrosion and impact, which can save money for the owners and users.

➢ **Warranty**

Rust-free panel container can offer longer warranty due to the panels' high performance.

➢ **Green manufacture**

Rust-free panel container can reduce noise, welding smokes, dust, VOCs, waste-water/slag and etc. during production and improve workers' safety.

The tare weight reduction 210kg, carbon emission reduction 900kg CO_2 per TEU

VS

Steel container		Rust free panel container
Easy to rusty Easy to wear, corrosion and impact	Rust free	Rust free inside box Wear-resistance Corrosion-resistance Impact-resistance
Strucuture:2 years Paint:5 years Floor:5 years	Durability	Strucuture:3 years Inside corrosion: 8 years Floor:6 years(with CFRTP skin)
Tare weight 2100 kg Carbon emission ~5000kg CO_{2e}	Green manufacture	Tare weight 1890kg Carbon-reduced by 900kg CO_{2e}↓ Paint reduced Welding reduced Waste emission reduced

Rust-free Panel Container

- **Rust-free panel container in future**

After many tests as mentioned before, CIMC have the confidence to promote this specialty container to the market and commercial voyage.

In September 2024, Starocean Marine Line bought **50 units** of rust-free panel container from CIMC, and this batch of this specialty container will be used for China-Japan line used for high-value goods.

We believe that the rust-free panel container would bring much value to our customers.

Rust-free Panel Material

- **CFRTP composite technology**

Continue….upcoming speech by our engineer about the CFRTP composite material used on container.

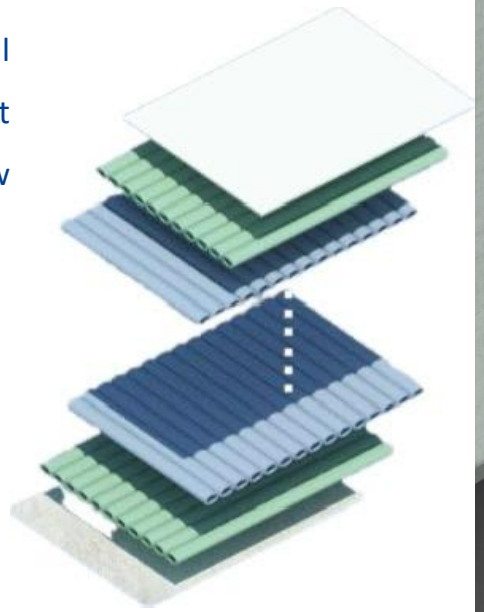
CONTENT

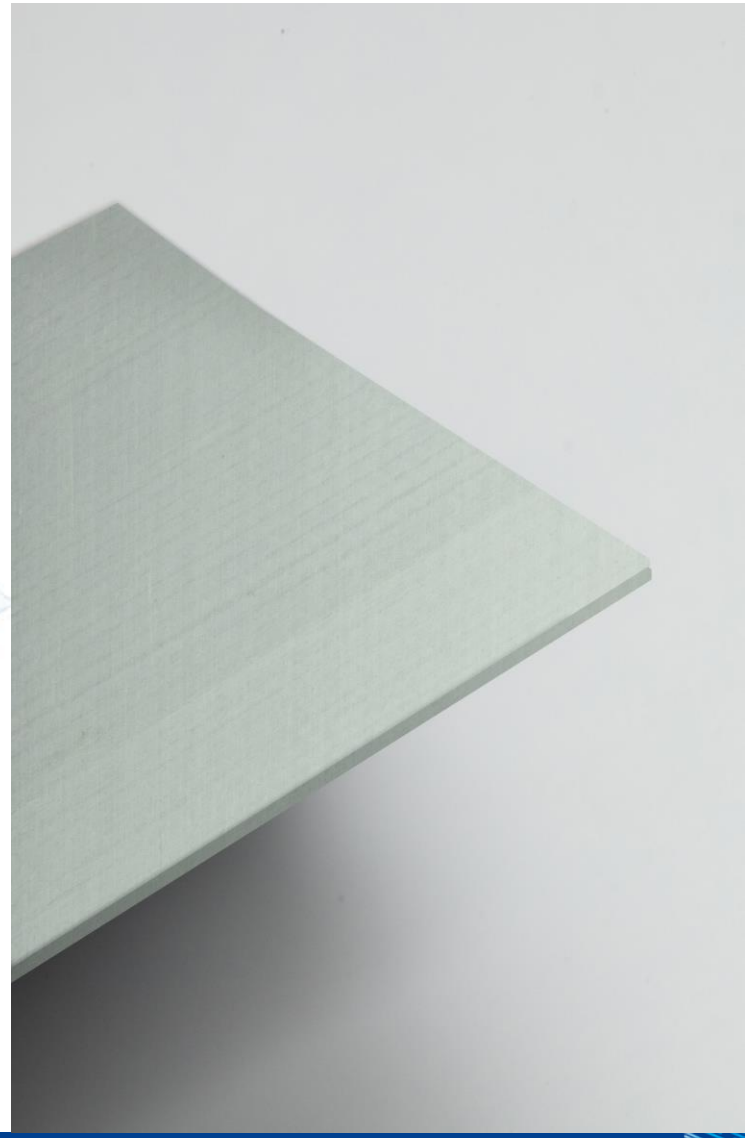
CONTENT 1

- What is the CFRTP composites

CFRTP composite

- The wall material of composite container is based on continuous & unidirectional fiber reinforced thermoplastic tape by resin melting impregnation and hot laminating processes.
- Thermoplastic resin -- Polypropylene is used as a matrix, which is green, environmentally friendly, odor-less and harmless, and is in line with the national industrial policy orientation of "replacing wood with plastic and replacing steel with plastic".
- The CFRTP composite sheet has better energy absorption effect than traditional metal and FRP sheets, has large elastic deformation, and can effectively resist external impact. It also has the functions of rust free, oil resistance and mildew resistance, is easy to clean, spray-free, and does not require anti-corrosion treatment.





Composition of composites

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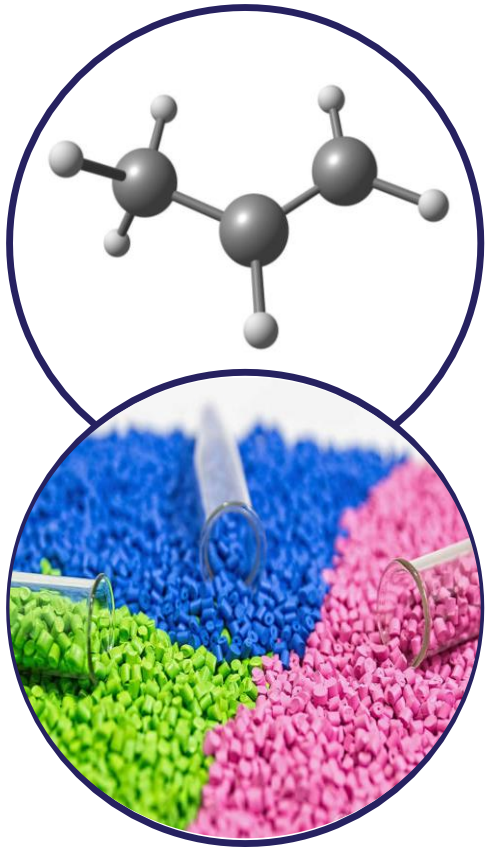
Matrix: Thermoplastic resin



- Physical change in processing

- Zero corrosion
- Color matching
- Paint free

- Environmentally friendly
- Reversible & easy to recycle

Reinforcement: High performance fiber

- Made of high-tensile continuous fibers
- Very high tensile and compressive strength

- Solvent-free；
- Fiber： Fiberglass、 Carbon fiber、 Kevlar fiber、 Biobased fiber、 Metal wire

Composition of composites - polypropylene

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Physical property

- White waxy material
- Transparent
- Density: 0.89-0.91g/cm^3
- Inflammable
- Melting point: 164~170°C
- Softening temperature: 155°C
- Temperature range: -30 ~140°C
- Tensile strength: 21~39 MPa
- Bending strength: 42~56 MPa
- Compressive strength: 39~56 MPa
- Notch impact strength: 2.2~5 kJ/m^2

Chemical property

- Odorless, tasteless, non-toxic
- Good chemical stability
- Excellent water resistance
- Excellent electrical performance
- Good resistance to high-frequency electrical insulation components
- Poor weather resistance and aging resistance

Composition of composites - glass fiber

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Physical property

- Inorganic non-metallic materials
- The diameter of a monofilament: 3-80μm
- Density: 2.4-2.76g/cm3
- Softening temperature: 500~750°C
- Boiling point: 1000°C
- Tensile strength: 4050MPa
- High elasticity coefficient
- Excellent rigidity
- Dimensional stability
- Low water absorptio

Chemical property

- Good heat resistance
- Excellent electrical insulation
- Non-Combustible
- Corrosion resistance
- Good chemical resistance
- Poor wear resistance

CONTENT 2

Advantages of CFRTP composites

Better impact resistance of CFRTP composites

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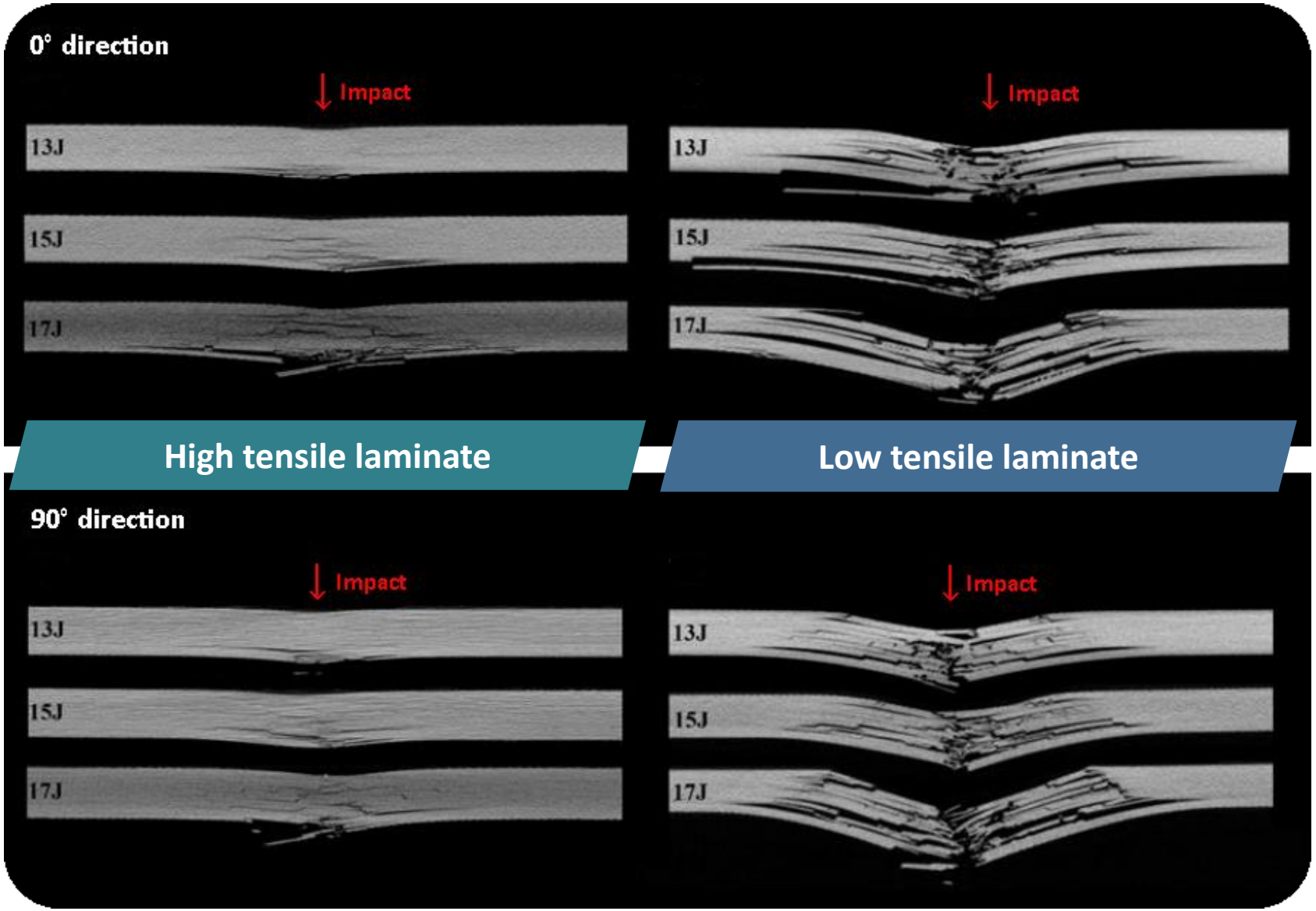

Comparison diagram of impact profiles at 0°/90°

- After impact
  - High tensile laminate:
    - Delamination failure
    - Minor matrix fracture occurred
  - Low tensile laminate:
    - Severe delamination failure
    - Bundles fibers broken

Innovations for material processing

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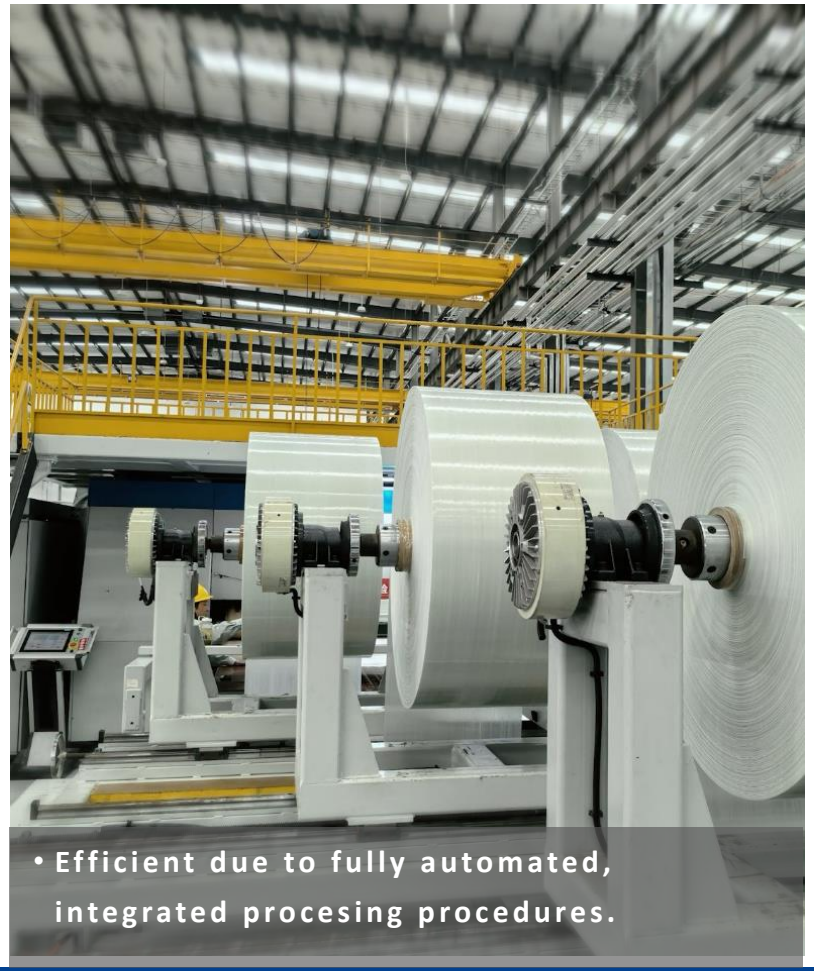
Melt impregnation

- Satisfactory occupational safety environment.

Laminating



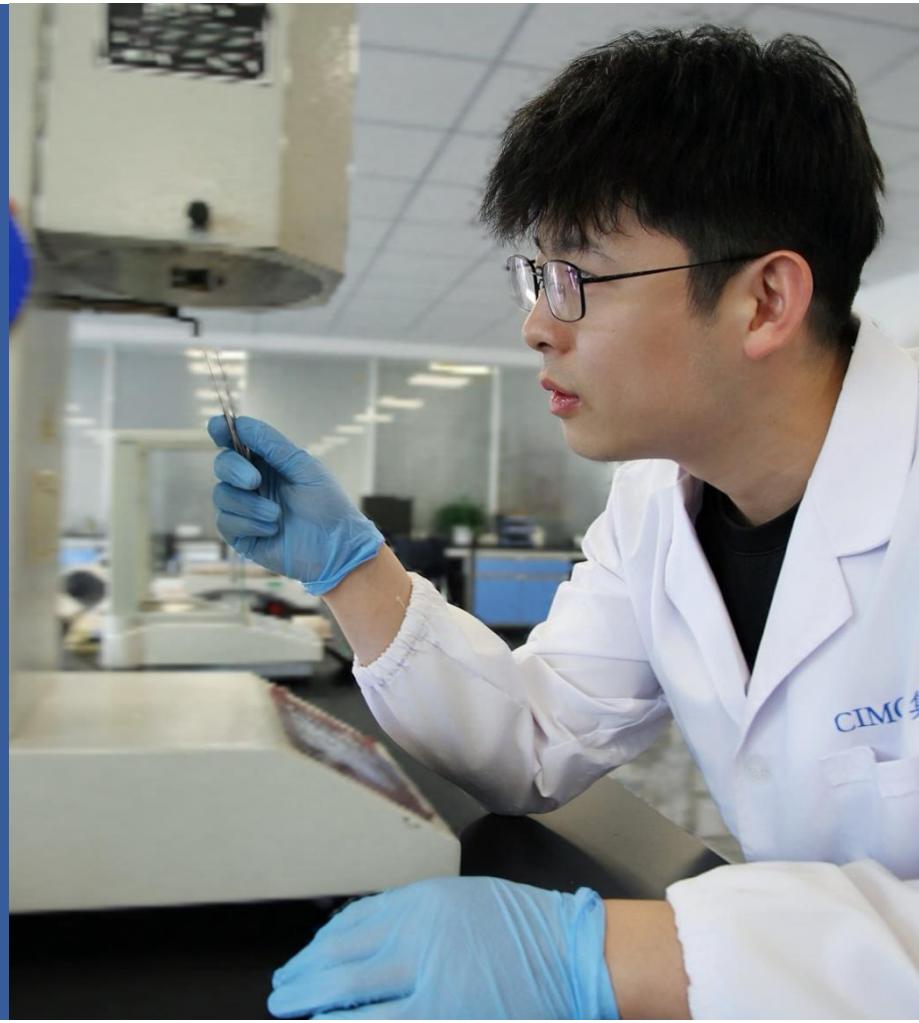
- Efficient due to fully automated, integrated procesing procedures.

Continuous hot pressing

- Stable quality, reproducible component manufacturing;
- Parts integration , supplied with standard widths of up to 3000 mm and depending on customer requirements - variable lengths

Full life-cycle performance evaluation of composites

- Conventional mechanical performance evaluation, including tensile strength, bending resistance, impact resistance, and compression resistance;
- Excellent temperature resistance, capable of withstanding temperatures ranging from -40 °C to 85 °C;
- Salt spray and chemical corrosion resistance;
- Light aging resistance



CONTENT 3

The future of CFRTP composites

Biobased, Biodegradable

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Biobased

- Biobased thermoplastic
- Biobased Fiber

Biodegradable

- Biodegradable thermoplastic, such as PLA

Container in future

We sincerely thank all of our customers to support & trust CIMC as always and work together to drive our industry moving forward to more environment-friendly and green manufacturing!

CIMC CONTAINERS

Container changes the world,

We change the container!

Thanks!