

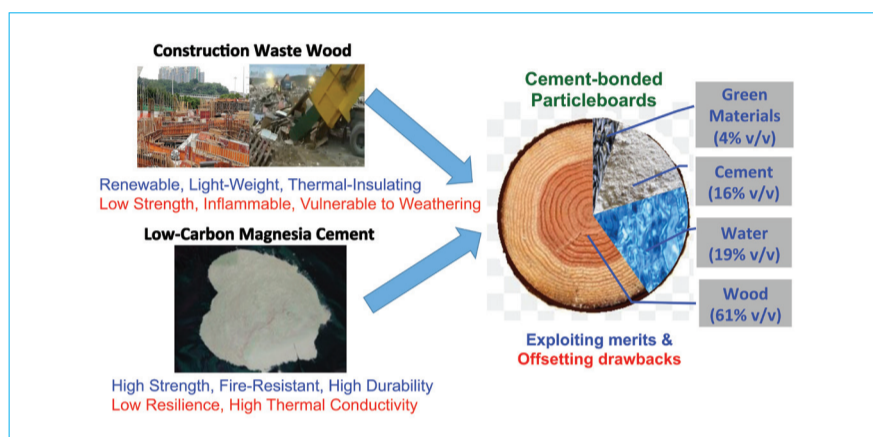
# 通過二氧化碳養護法 將廢棄木材製成低碳水泥刨花板

## Upcycling Wood Waste into Particleboard by CO<sub>2</sub> Curing and Adding Low-carbon Cement

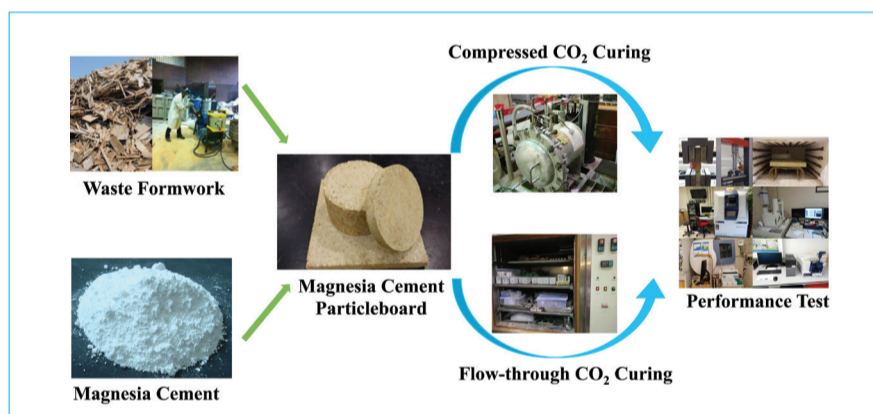
用作室內裝飾牆面板及隔音板的建築材料

Green construction materials for interior decorative wall panels and noise barriers

這種創新的低碳回收技術利用氧化鎂水泥和二氧化碳養護法，把廢棄木材轉化成環保水泥刨花板。與傳統木材相比，木材與水泥結合而成的刨花板具有更佳的性能，例如較理想的隔熱和隔音效果等。有別於一般水泥，低碳氧化鎂水泥與木材有較高的相容性，所製造的刨花板亦有較佳的穩定性和物理性質。同時，二氧化碳養護法能促進水泥的強度，更能吸收和隔離二氧化碳（9 wt.%），可以降低生產過程的碳足印。因此，我們開發的刨花板具有高抗折強度（12.9 MPa）、低密度（1.5 g/cm<sup>3</sup>）、隔熱（0.29 W/mK）及隔聲（31 dB(A)）等優異特性。



回收廢棄木材製成有價值的水泥刨花板  
Recycling waste wood into value-added cement-bonded particleboards



加入氧化鎂水泥和二氧化碳養護法的刨花板生產流程圖  
Flowchart of particleboard production by using magnesia cement and CO<sub>2</sub> curing

This innovative and low-carbon technology aims to upcycle wood waste into eco-friendly cement-bonded particleboard by adding magnesia cement and adopting the process of carbon dioxide (CO<sub>2</sub>) curing. The integration of wood and cement into particleboards has many advantages over the conventional wood materials, e.g. better noise and fire insulation. Compared to traditional cement, low-carbon magnesia cement is more compatible with wood, and improves the stability and mechanical properties of particleboard. Meanwhile, the CO<sub>2</sub> curing process drastically strengthens the magnesia cement. It also facilitates CO<sub>2</sub> sequestration (9 wt.%) and reduces carbon footprint during production. The produced particleboards demonstrates superior features of high flexural strength (12.9 MPa), light weight (1.5 g/cm<sup>3</sup>), thermal insulation (0.29 W/mK), and acoustic insulation (31 dB(A)).

### Principal Investigator

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### 特色與優點

- 水泥刨花板集合了木材與水泥的優點，具有强度高、輕巧、無甲醛揮發、良好的隔音效果、隔熱和耐火等優異性能。
- 低碳的氧化鎂水泥與木材有較高的相容性，並能加速刨花板早期強度的提升。
- 二氧化碳養護法能夠促進強度的提升、尺寸的穩定性、污染物的固定和二氧化碳隔離。

### 應用

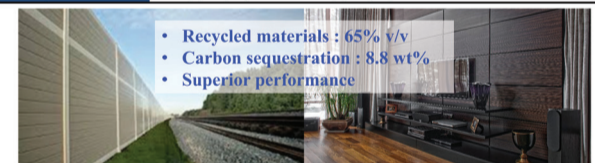
- 室內耐火裝飾牆板
- 室外隔音板

### 獎項

- 第45屆瑞士日內瓦國際發明展 - 金獎 (2017年3月)
- 香港工程師協會2015年度環境類冠軍論文
- 國際固體廢物會議2015年度最佳學生海報

### Mechanical properties, acoustic/thermal insulation, and fire resistance

	Our Value	Market's Value	Comparison	Standard
Flexural strength	>12.9 MPa	>9.0 MPa	<b>+43%</b>	ISO 8335
Thickness swelling	<0.8%	<2.0%	<b>-60%</b>	ISO 8335
Acoustic insulation	33 dB(A)	30 dB(A)	<b>+10%</b>	ISO 140
Thermal conductivity	0.29 W/(mK)	0.30 W/(mK)	<b>-13%</b>	BS 13986
Fire Rating	>240 min	>120 min	<b>+100%</b>	BS 476-22
Formaldehyde Emission	0 ppb (E0)	<0.75 ppb (E1)	-	EN 13986



Noise Barriers

Interior Fire-Resistant Panels

氧化鎂水泥刨花板的性質與應用

Properties and applications of magnesia cement particleboard

### Special Features and Advantages

- Our cement-bonded particleboard demonstrates high strength, light weight, zero formaldehyde emission, good noise insulation, enhanced fire resistance, and low thermal conductivity.
- With greater compatibility with wood, low-carbon magnesia cement accelerates early strength enhancement of particleboard.
- CO<sub>2</sub> curing facilitates mechanical strength, dimensional stability, contaminant immobilization, and carbon utilization and sequestration.

### Applications

- Interior fire-resistant decorative wall panels
- Outdoor noise barriers

### Awards

- Gold Medal – 45<sup>th</sup> International Exhibition of Inventions of Geneva, Switzerland (Mar 2017)
- Hong Kong Institution of Engineers - Champion of 2015 Environmental Paper Award
- International Conference on Solid Waste 2015 - Best Student Poster Award

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