WATER-BASED ADHESIVE
AIT CHEMICAL, CORAL INDUSTRIES

1. **VENEER AND WOOD BONDING**
   - i. VENEER TO PARTICLE BOARD, PLYWOOD, MDF, ETC.
   - ii. WOOD TO METALS, PLASTICS, GLASS, AND SUBSTRATE
2. **PLYWOOD, MDF, PARTICLEBOARD BINDING**
   - i. PLYWOOD LAMINATION
   - ii. PARTICLE BOARD, MDF, HDF LAMINATION
3. **FOAM AND SUBSTRATE BONDING**
   - i. ALL PU, EVA, INCLUDING EPE, EPP
   - ii. LEATHERS, FABRICS, PLASTICS, WOODS, AND METALS

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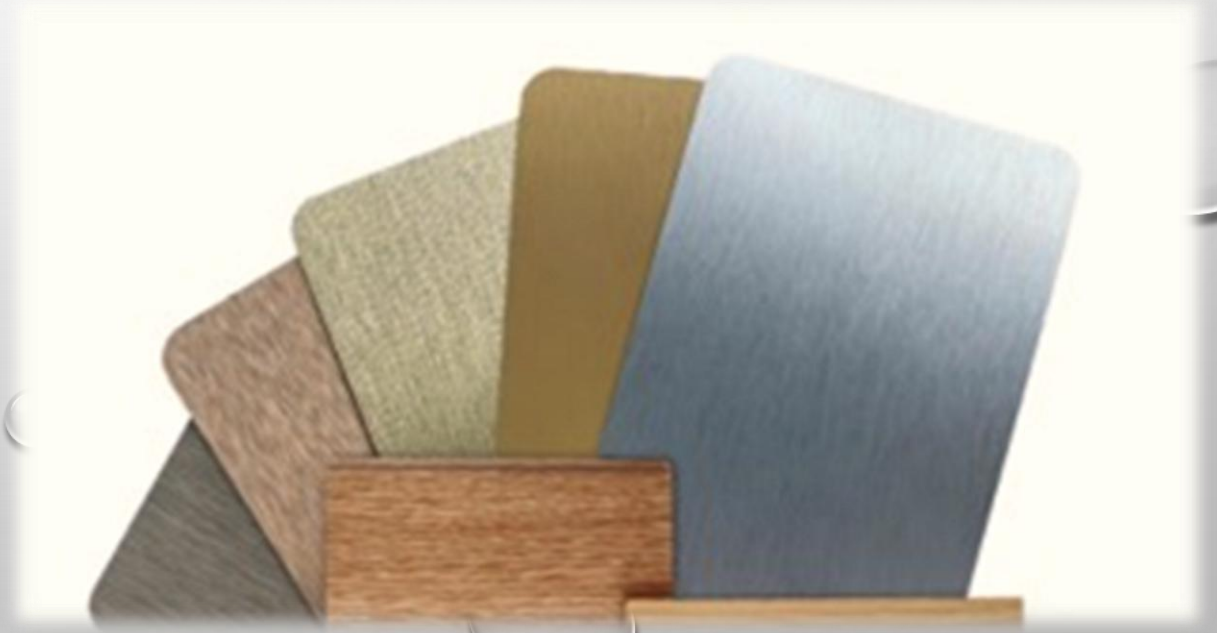
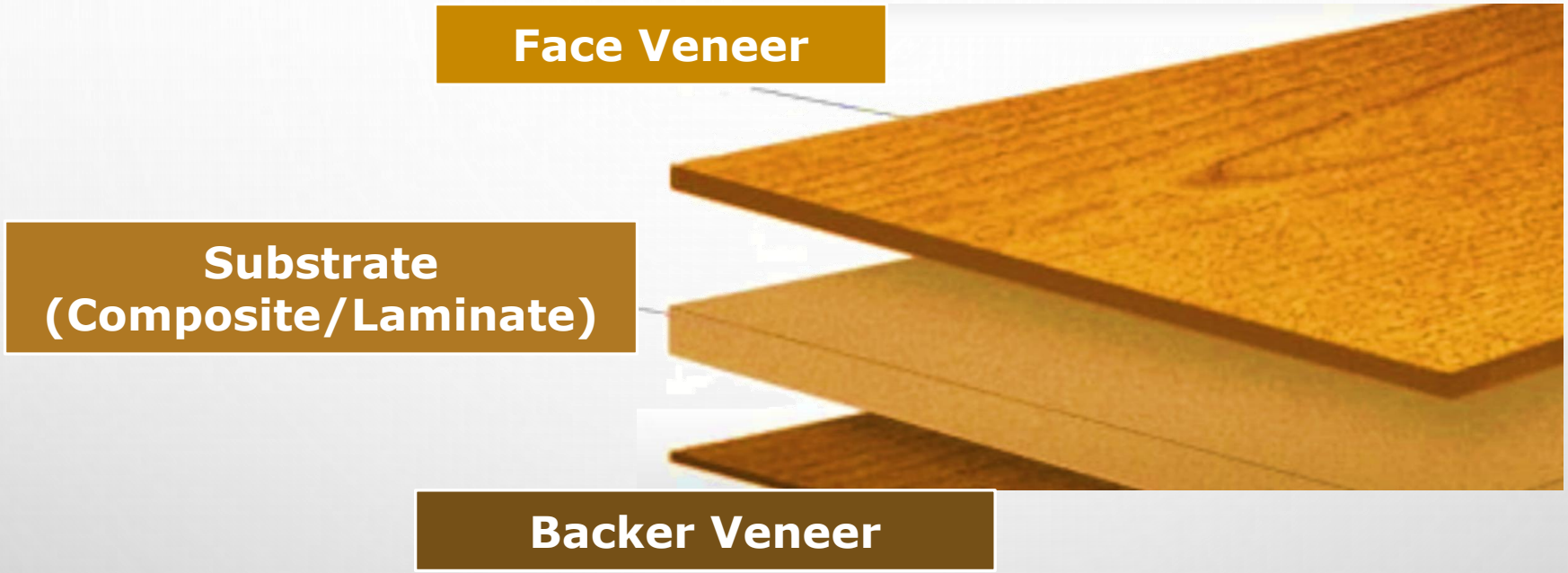


VENEER-TO-SUBSTRATE (WOOD) BONDING



Veneer-to-Substrate (Wood) Laminate Manufacturing

- Pain: VOC, Formaldehyde regulations, worker safety, odor
- Priority: sprayability, comfort, durability → CC4358; ABX2860; AB2250-FT

Coral Industries

AiT Chemical

Quickbond™ AB2250-FT
Fastest Tacking Field Installation Foam and Wood Adhesive

Veneer and wood bonding water-based adhesive

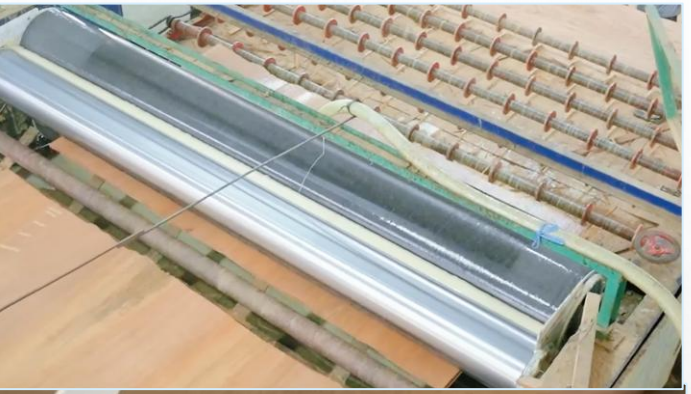
- Formaldehyde-free
- Solvent-free and No-VOC
- Highest bond strength and water-resistant with hot-press
- Fastest cold-pressing or cold roll lamination for unparalleled throughput

Veneer-to-Wood (Particle Board, MDF, or HDF) with QUICKBOND™ AB2250-FT, ABX2860, and CC4358 Water-Based Adhesive using Cold Press (or Roll-Lamination) Bonding Process

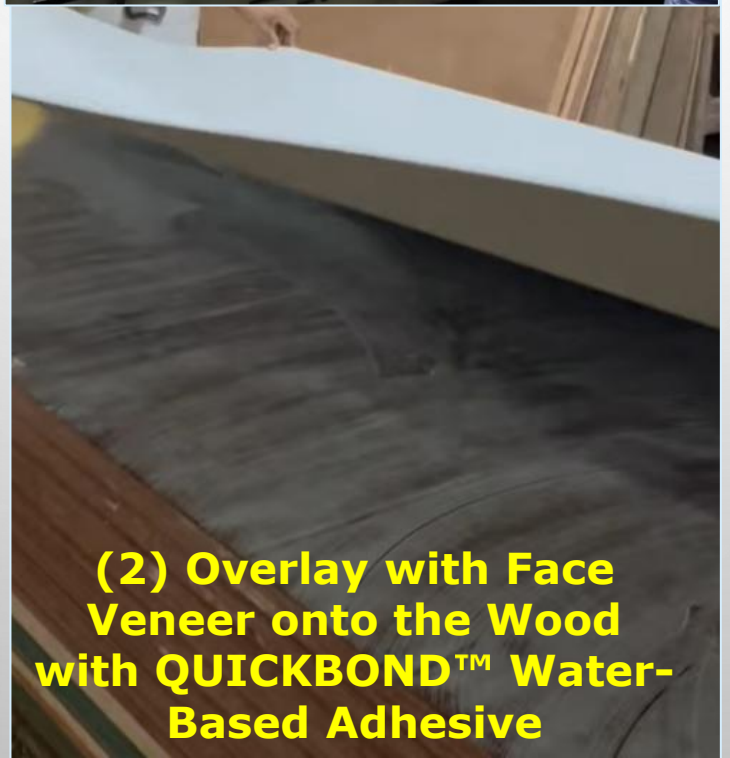
1). Spray or roll coat water-based adhesive onto the wood or veneer surface. Only one-side is needed to coat with QUICKBOND™ CC4358 water-based adhesive.

2). Align the veneer and wood composite/laminate with the water-based adhesive within 3 minutes. Apply roller pressure or cold press in 3-5 minutes. The veneer laminate has green strength to stay flat and the water-based adhesive will "cure" to 100% of full adhesive strength within 12-24 hours.

Veneer-to-Wood (Particle Board, MDF, or HDF) Cold Press Bonding Process with QUICKBOND™ Water-Based Adhesive



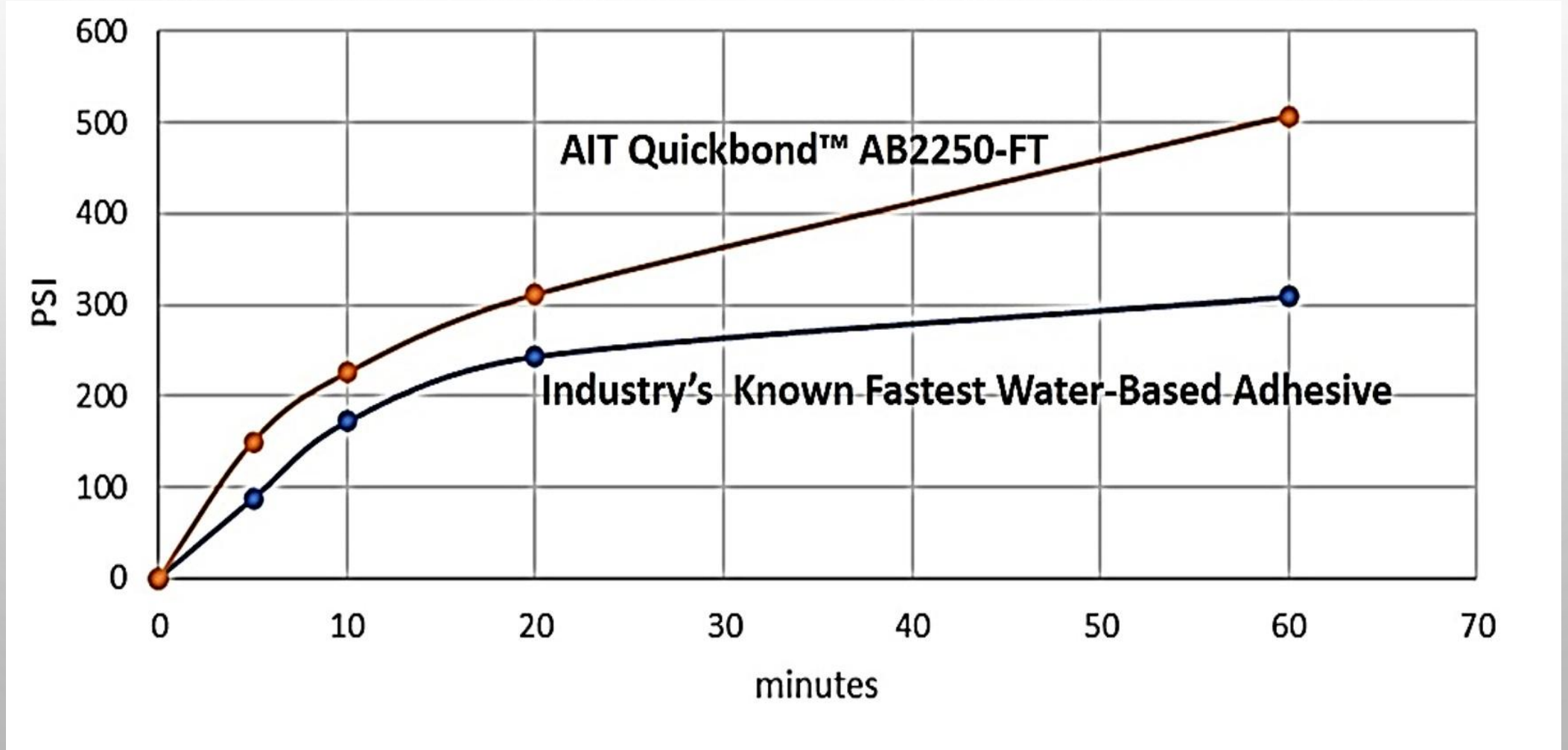
(1) Apply QUICKBOND™ Water-Based Adhesive onto the W00d Side



(2) Overlay with Face Veneer onto the Wood with QUICKBOND™ Water-Based Adhesive

(3) Laminate Bonding with Cold Press or Calender Rolling Pressure for Flatness

Veneer-to-Wood (Particle Board, MDF, or HDF) with QUICKBOND™ Cold Press Bonding Water-Based Adhesive: AB2250-FT and ABX2860 with Instant Bond Strength Build-up at Ambient



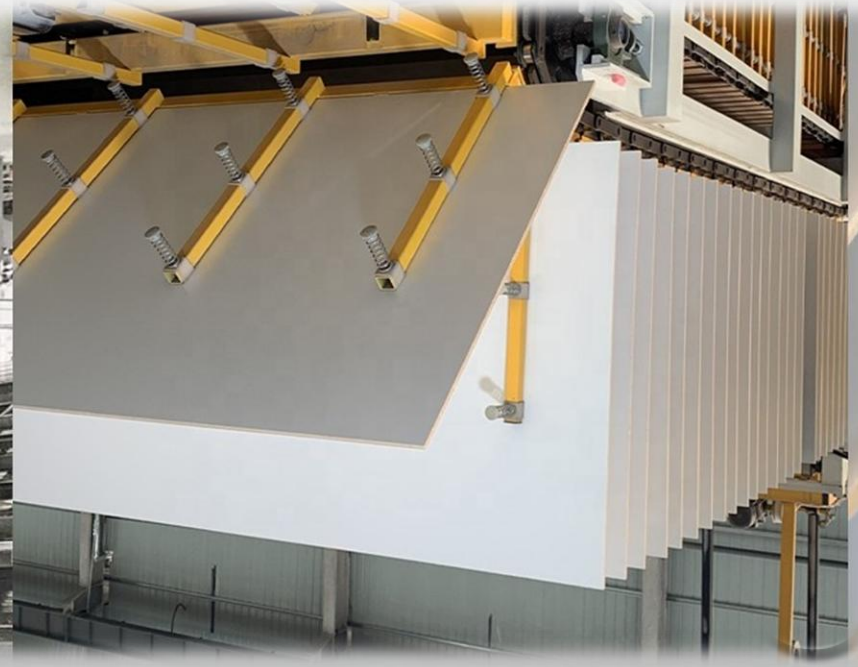
The high green strength and fast strength build-up, QUICKBOND™ AB2250-FT and ABX2860, are ideal for a furniture workshop

The high green strength and fast strength build-up of QUICKBOND™ AB2250-FT and ABX2860 is ideal for a furniture workshop

Wood-to-Wood & Wood-to-Substrate(Plastics) Laminate Manufacturing

- Pain: VOC regulations, worker safety, odor
- Priority: sprayability, comfort, durability ⇨ CC4358

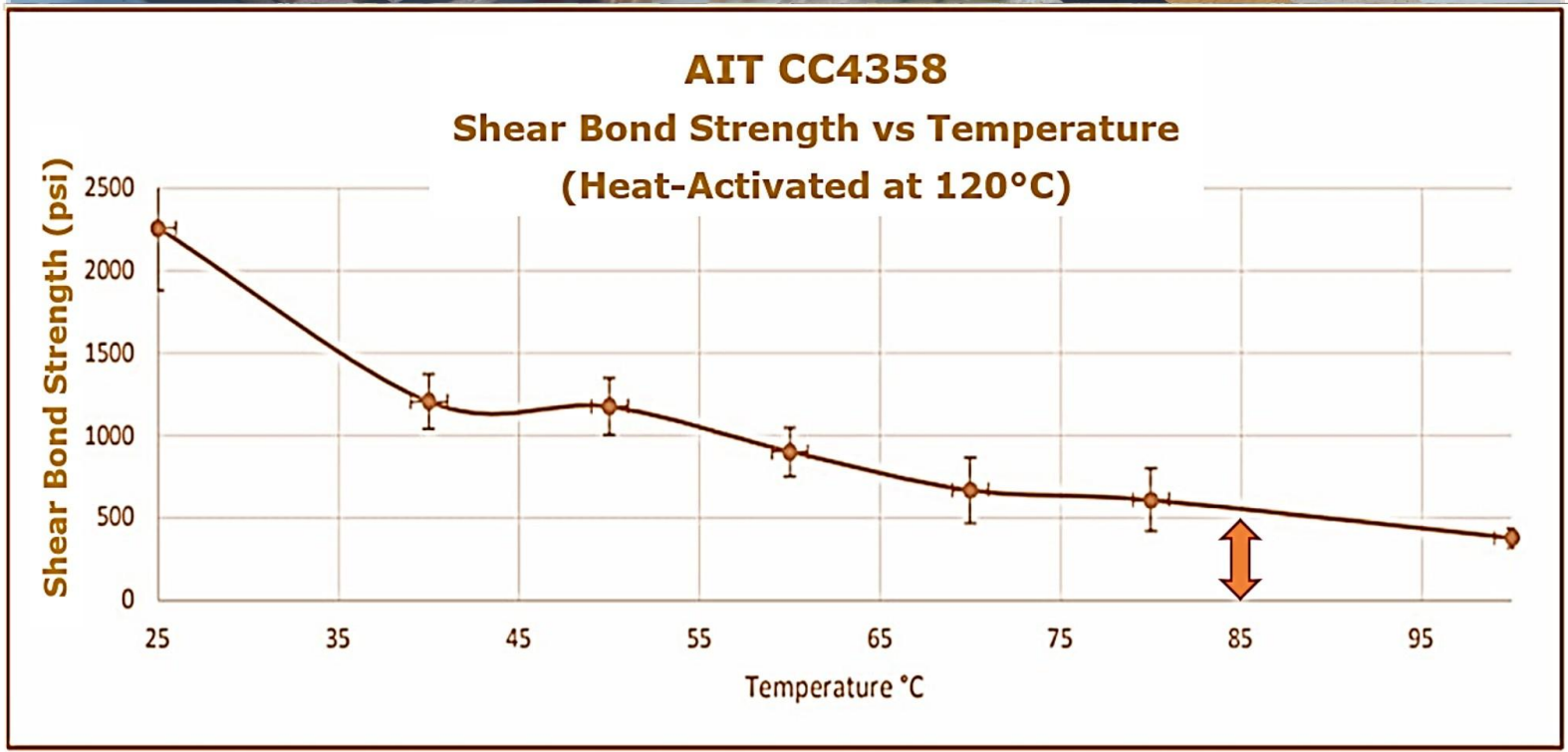
Water-Moisture Resistant Veneer-to-Wood (OSB, Particle Board, MDF, or HDF) with QUICKBOND™ Water-Based Adhesive: CC4358 and ABX2860 using Cold or Hot Press Process



QUICKBOND™ CC4358 Water-Based Adhesive Provides Toughness and Water-Moisture with the use of Hot Press (or Heat Roll-Lamination) Bonding Process

Veneer to Wood Lamination with Formaldehyde-Free, VOC-Free and Solvent-Free Water-Based Adhesive

- High bond strength, creep, and water-soaking resistant
- Instant melt-bonding with 120°C hot-press



Veneer-to-Wood (Particle Board, MDF, or HDF) with QUICKBOND™ CC4358 Water-Based Adhesive using Hot Press "Instant" Heat-Activated Bonding

Formaldehyde-Free, VOC and Solvent-Free Veneer Lamination manufacturing using QUICKBOND™ CC4358 Water-Based Adhesive with Same High Bond Strength and Water-Soaking Resistance

1). Spray or roll coat water-based adhesive onto the wood or veneer surface. Only one-side is needed to coat with QUICKBOND™ CC4358 water-based adhesive.

2). Align the veneer and wood composite/laminate with the water-based adhesive within 3 minutes. Apply roller pressure or cold press in 3-5 minutes. The veneer laminate has green strength to stay flat and the water-based adhesive will "cure" to 60-80% of 2,500 psi full shear adhesive strength within 12-24 hours.

3). Heat without pressure to 105-125ºC above heat-activation temperature for 5-10 minutes to achieve full heat-activated adhesive shear bond strength.

Wood to Metals, Plastics, Glass, & Other Substrate Lamination Bonding with Water-Moisture-Resistant QUICKBOND™ CC4358 Water-Based Adhesive using Hot Press "Instant" Heat-Activated Bonding

PLYWOOD MANUFACTURING

WITHOUT

FORMALDEHYDE, SOLVENT, AND VOC

WITH

HEAT-ACTIVATED QUICKBOND™ CC4358 WATER-BASED ADHESIVE

Traditional Plywood Manufacturing with Phenol or Urea Formaldehyde

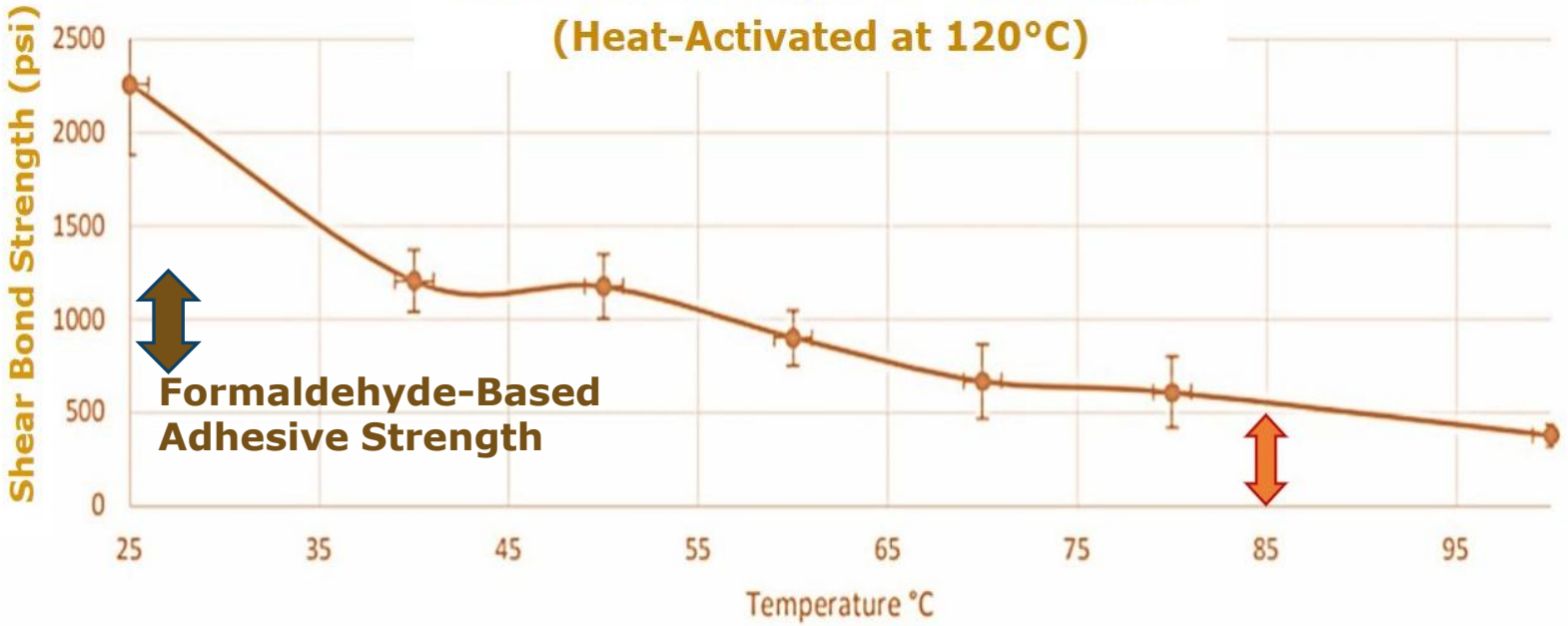
Water-Based Adhesive: CC4358

- Formaldehyde-free, VOC and solvent-free
- Safe, healthy workplace without loss in performance
- High bond strength, creep, and water-soaking resistance
- Hot-press instant melt-bonding at 120°C

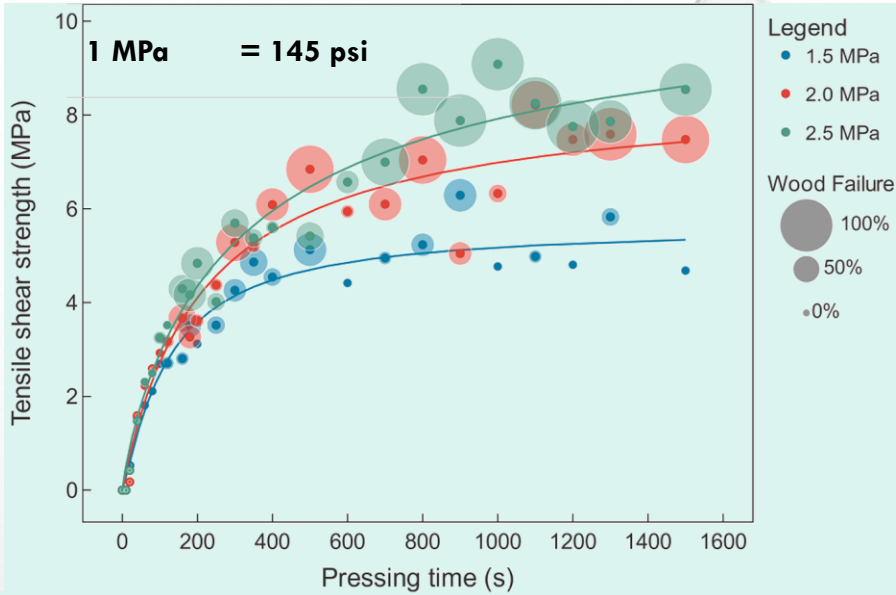
AIT CC4358

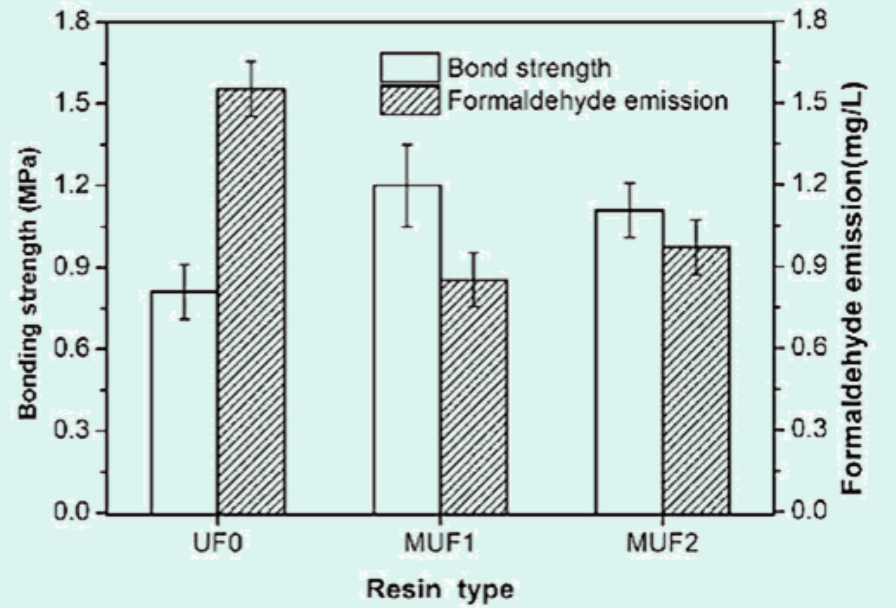
Shear Bond Strength vs Temperature

(Heat-Activated at 120°C)



Formaldehyde-Based Adhesive Strength





PERFORMANCE AND COST-OF-OWNERSHIP OF FORMALDEHYDE-BASED & FORMALDEHYDE-FREE ADHESIVES FOR PLYWOOD MANUFACTURING

Technology	Typical Resin Solids Loading*	Press Temperature	Press Time	Typical Dry Shear Strength	Typical Wet Shear Strength	Water-Soaking	Water Boil Test	Flexibility	Formaldehyde Regulations
Urea Formaldehyde	140-220 g/m²	130–150°C	10-20 min	2–4 MPa	1-2 MPa	Poor	Fail	Brittle	High CARB Phase 2 EPA TSCA Title VI
PRF (Phenol-Resorcinol-Formaldehyde)	**200-300 g/m²**	**130–150°C**	**10-20 min**	**2–5 MPa**	**1.5–3 MPa**	**Excellent**	**Pass**	**Brittle**	**High CARB Phase 2 EPA TSCA Title VI**
QUICKBOND™ CC4358	**80–180** g/m²**	**105–125°C**	**2–5 min**	**8–18 MPa**	**6–12 MPa**	**Excellent**	**Pass**	**Flexible**	**No Emission**
Soy protein	150–300 g/m²	110–150°C	3–8 min	1.0–2.5 MPa	0.7–1.5 MPa	?	?	?	No Emission
Waterborne PUD (Reactive)	80–180 g/m²	60–130°C	2–10 min	2–5 MPa	1.5–4 MPa	Formulation Dependent	Formulation Dependent	High	No Emission
Acrylic emulsion	80–180 g/m²	Ambient–120°C	5–30 min	1–3 MPa	0.5–2 MPa	Formulation Dependent	Formulation Dependent	High	No Emission

***Total wet adhesive application, depending on solids content and veneer species.**

****Price of QUICKBOND™ CC4358 formaldehyde and VOC-free water-based adhesive matches that of the PRF adhesive**

AIT HEAT-ACTIVATED WATER-BASED ADHESIVES CC4358

FOR

PLYWOOD, OSB, & PARTICLEBOARD MANUFACTURING

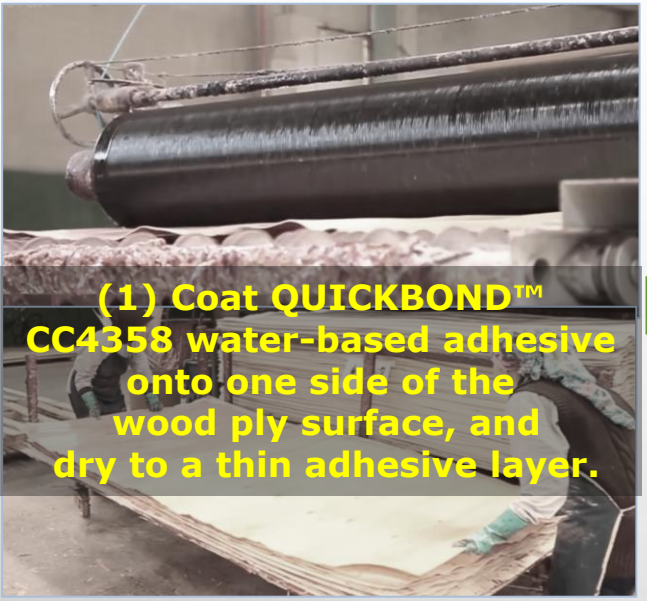
The adhesive share of the total panel cost is relatively minor. A formaldehyde-VOC-solvent-free, water-based adhesive that delivers high performance and productivity while meeting all regulatory, industry, and green building initiatives may be cost-effective.

Panel Type	Adhesive Share of Total Panel Cost
Commodity plywood	5–12%
MDF	8–15%
Decorative laminated panels	10–25%
High-end engineered composites	15–35%

Plywood Manufacturing with Formaldehyde-VOC-Solvent-Free Instant Melt-Bonding Heat-Activated Water-Based Adhesive CC4358

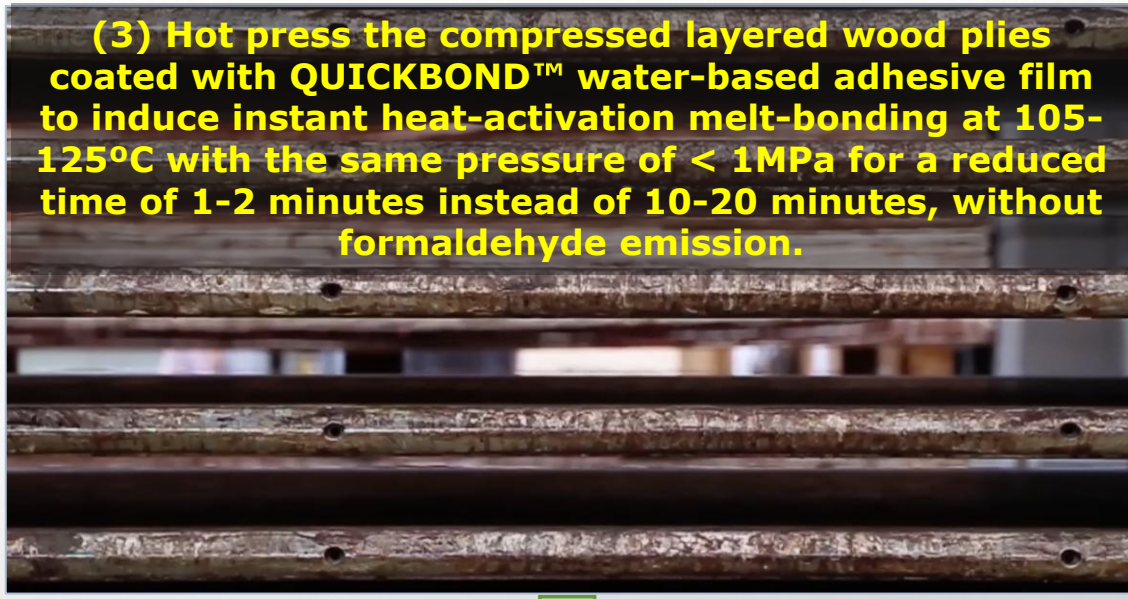
Plywood Laminate Manufacturing with QUICKBOND™ CC4358 water-based adhesive uses the same adhesive coating, cold and hot press processes

The plywood products have higher shear strength and marine-grade performance. Formaldehyde-free, solvent-free, and VOC-free operation ensures an eco- and health-friendly workplace and compliance with green building standards.



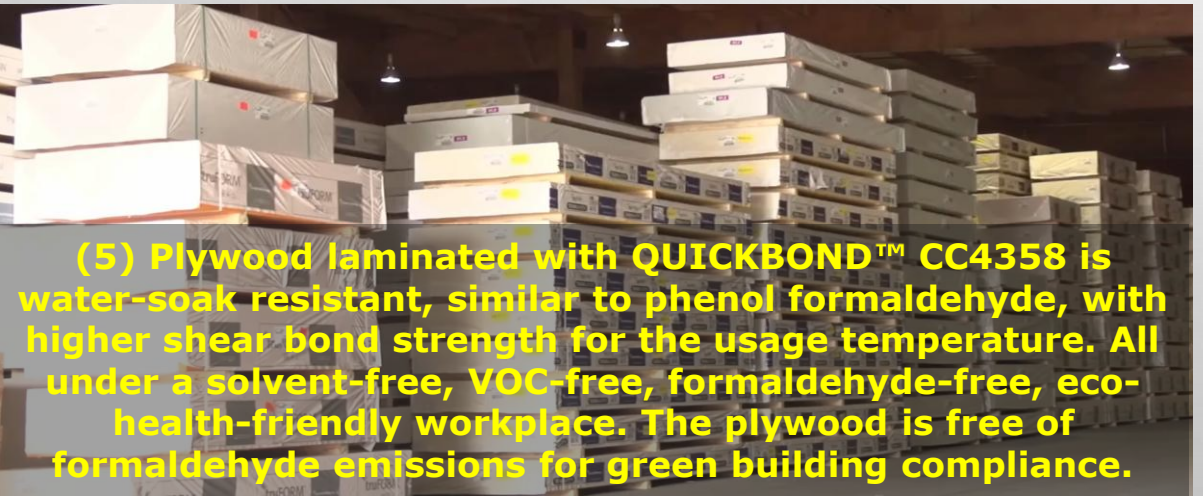
(1) Coat QUICKBOND™ CC4358 water-based adhesive onto one side of the wood ply surface, and dry to a thin adhesive layer.

(2) Cold press the layered wood plies coated with QUICKBOND™ CC4358 water-based adhesive film with <1Mpa pressure.



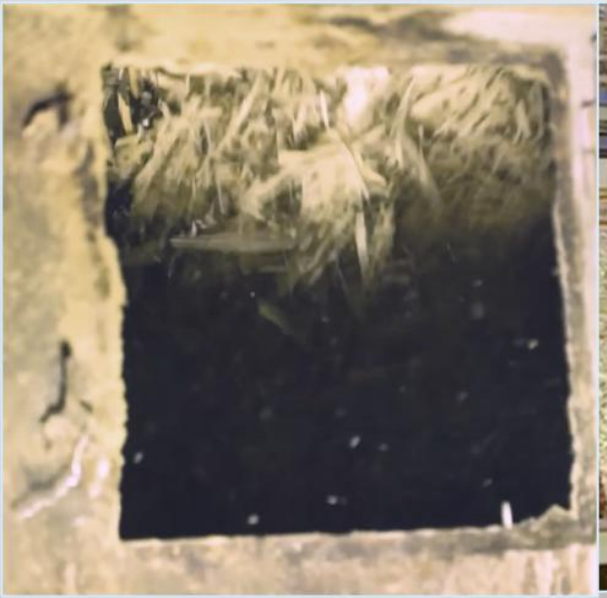
(3) Hot press the compressed layered wood plies coated with QUICKBOND™ water-based adhesive film to induce instant heat-activation melt-bonding at 105-125°C with the same pressure of < 1MPa for a reduced time of 1-2 minutes instead of 10-20 minutes, without formaldehyde emission.

(4) Fully lamination-bonded plywood is cut and finished, and ready for packaging for shipment.



(5) Plywood laminated with QUICKBOND™ CC4358 is water-soak resistant, similar to phenol formaldehyde, with higher shear bond strength for the usage temperature. All under a solvent-free, VOC-free, formaldehyde-free, eco-health-friendly workplace. The plywood is free of formaldehyde emissions for green building compliance.

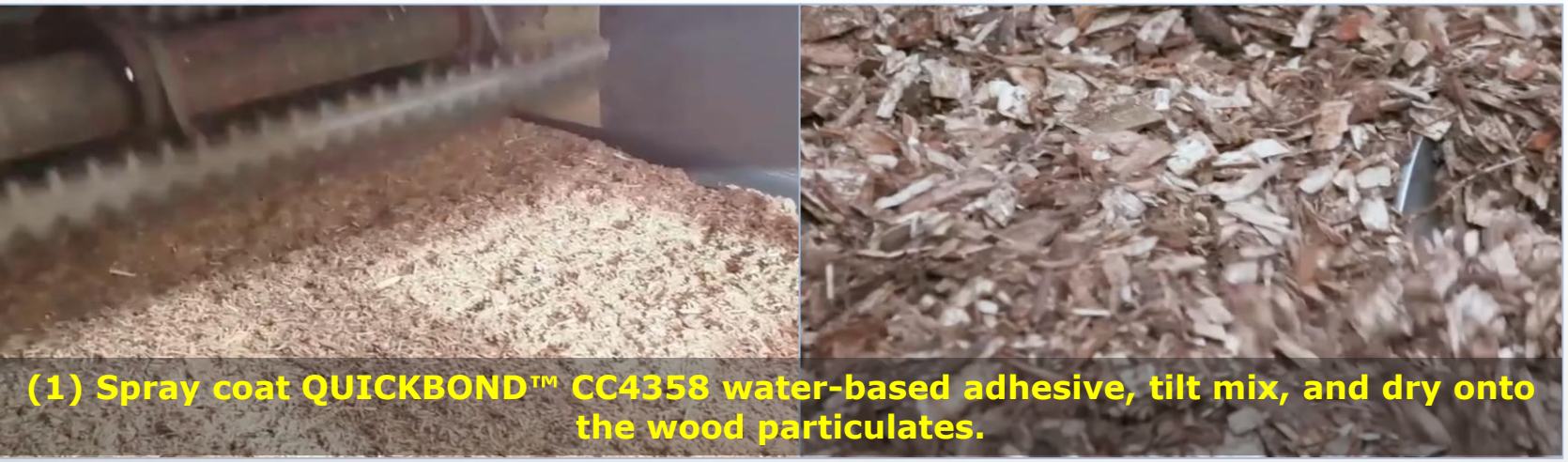
OSB (Oriented Strand Board) Plywood Manufacturing with Formaldehyde-VOC-Solvent-Free Instant Melt-Bonding Heat-Activated Water-Based Adhesive CC4358



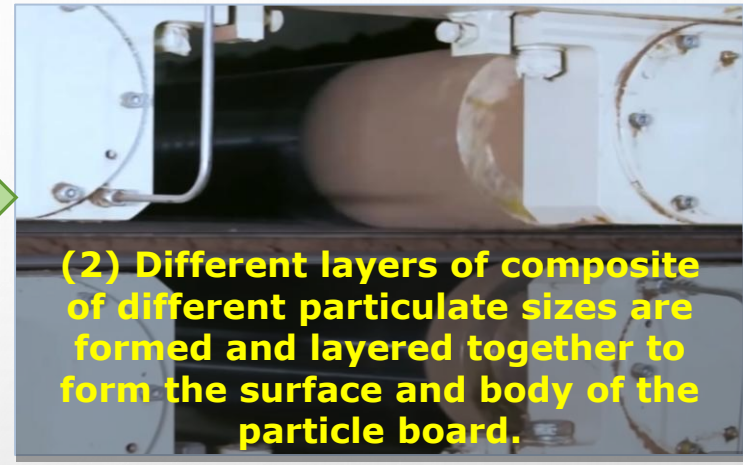

PARTICLE BOARD MANUFACTURING WITH FORMALDEHYDE-SOLVENT-VOC-FREE INSTANT MELT-BONDING HEAT-ACTIVATED QUICKBOND™ CC4358 WATER-BASED ADHESIVE

Particle (Chip) Board Manufacturing with QUICKBOND™ CC4358 water-based adhesive and the same cold and hot press processes

The plywood products have higher shear strength and marine-grade performance. Formaldehyde-free, solvent-free, and VOC-free operation ensures an eco- and health-friendly workplace and green building compliance.

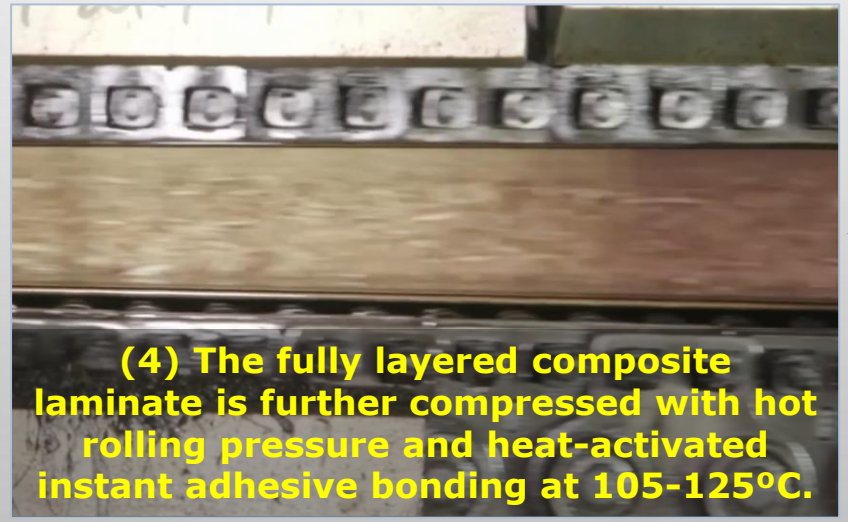


(1) Spray coat QUICKBOND™ CC4358 water-based adhesive, tilt mix, and dry onto the wood particulates.

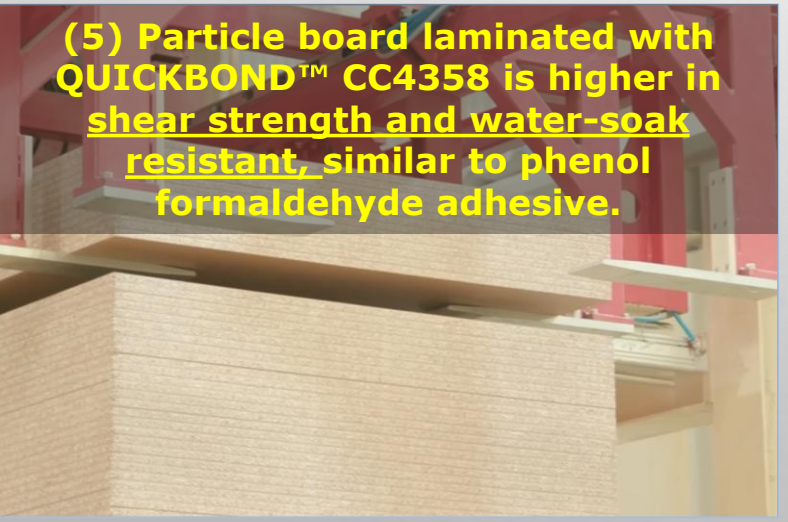


(2) Different layers of composite of different particulate sizes are formed and layered together to form the surface and body of the particle board.

(3) Layers are compressed further with hot rolling pressure to further compress into a fused single body.



(4) The fully layered composite laminate is further compressed with hot rolling pressure and heat-activated instant adhesive bonding at 105-125°C.



(5) Particle board laminated with QUICKBOND™ CC4358 is higher in shear strength and water-soak resistant, similar to phenol formaldehyde adhesive.

AIT CC4358 WATER-BASED HEAT-ACTIVATED ADHESIVE FOR LAMINATION-BINDING MANUFACTURING OF PLYWOOD, OSB, PARTICLEBOARD & MDF

Category	UF	Water-Based Reactive PUD	AIT water-Based Heat-Activated Adhesive CC4358
Raw material cost	Very low	High	Medium/High
Bond strength	**High**	**Very high**	**Very high**
Water resistance	**Moderate**	**Excellent**	**Excellent**
Heat resistance	Moderate	Good-excellent	Excellent
Flexibility	Brittle	Flexible	Flexible
Formaldehyde emission	**Yes**	**None**	**None**
VOC	**Low-moderate**	**Very low**	**None**
Press speed	**Very fast**	**Slower**	**Very fast**
Hot press temp	**110–140°C**	**60–120°C**	**95–125°C**
Cold press capability	Poor	Good	Excellent
Veneer penetration	High	Moderate	Moderate
Durability	**Interior only**	**Interior + exterior**	**Interior + exterior**
Equipment fouling	**Low**	**Moderate**	**Low**
Regulatory future	Declining	Growing rapidly	Growing rapidly

CC4358 AIT WATER-BASED HEAT-ACTIVATED ADHESIVE IS INHERENTLY WATER-MOISTURE RESISTANT IN LAMINATION-BINDING FOR MDF, PLYWOOD, OSB, PARTICLEBOARD

CC4358-FR AIT WATER-BASED HEAT-ACTIVATED ADHESIVE IS A FIRE-RETARDANT ENHANCED VERSION IN LAMINATION-BINDING FOR MDF, PLYWOOD, OSB, PARTICLEBOARD

COST-PERFORMANCE OF WATER-BASED ADHESIVES

Adhesive Type	Best Use	Strength	Water Resistance	Cost	Main Limitation
UF (Urea Formaldehyde)	Interior plywood, MDF, particleboard	High	Moderate	Lowest	Formaldehyde emission
MUF (Melamine UF)	Moisture-resistant panels	Very high	Good	Low-medium	Still emits formaldehyde
PF (Phenol Formaldehyde)	Exterior plywood, structural panels	Excellent	Excellent	Medium	Dark bond line, high cure temp
pMDI	**OSB, structural composites**	**Excellent**	**Excellent**	**High**	**Difficult handling**
Resorcinol	**Marine & aerospace wood bonding**	**Exceptional**	**Exceptional**	**Very high**	**Expensive, slow cure**
PVA	Furniture assembly, woodworking	Good	Poor–moderate	Low	Weak moisture resistance
PUR / PUD	High-performance laminating & assembly	Excellent	Excellent	High	Higher cost
AIT CC4358 Heat-Activated Water-Based Adhesive	**Exterior plywood, structural panels, OSB, structural composites, Marine & aerospace wood bonding**	**Exceptional**	**Excellent**	**Higher material cost mitigated with productivity and performance**	**Realizing cost-performance advantage**

The adhesive share of the total panel cost is relatively minor. A formaldehyde-VOC-solvent-free, water-based adhesive that delivers high performance and productivity while meeting all regulatory, industry, and green building initiatives may be cost-effective.

Binder System	Typical Binder Loading (% dry solids on fiber)	Internal Bond (MPa)	24-h Thickness Swell (%)	Relative Binder Cost ($/kg solids)	Relative Resin Cost per m²*	Relative Environmental Cost
UF	**8–12%**	**0.6–1.0**	**12–25**	**1.0×**	**1.0×**	**1.0×**
MUF	10–14%	0.7–1.2	8–15	1.3–1.8×	1.5–2.0×	1.0×
pMDI	2–5%	0.8–1.5	4–10	3–5×	0.8–1.5×	0.5-1.0×
Water-Based CC4358	**3–6%**	**1.5–3.0**	**3-8**	**1.5–3×**	**1.0-2.0X**	**0.0×**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