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TECHNICAL NOTE

SGP / Ionoplast Laminated Glass in Extreme Cold: Freeze–Thaw Fogging, Bubbles, and Delamination

By Peter Lin

CNCGLASS · The cold-climate question

Architects, façade consultants, and building owners in alpine, northern, and high-altitude markets ask a practical question: after many winters of freeze and thaw, will ionoplast (SGP-type) laminated glass fog between the plies, grow bubbles, or delaminate at the edge?

That worry is fair. Temperature swings stress every interface in a laminate—glass-to-film adhesion, residual moisture pathways, edge seals, and any trapped process gas. CNCGLASS (CNC Ucolin Interlayer Technology Co., Ltd., Shenzhen) wrote this note so buyers and fabricators can separate marketing slogans from a disciplined cold-cycle check, inspection criteria, and residual adhesion judgment for stiff ionoplast stacks.

CNCGLASS · What freeze–thaw actually stresses

A freeze–thaw cycle is not only “cold weather.” It is a controlled or natural sequence of cool-down, dwell at low temperature, recovery toward ambient, and rest—then repeat. Differential contraction between glass and interlayer, moisture that migrates or condenses if the bond path is weak, and incomplete degassing from lamination can all show up as optical or edge defects after cycling.

- Fogging or haze between plies — often linked to moisture, volatile residues, or incomplete bonding rather than “cold” alone.
- Bubbles or voids — process air, vacuum loss, or gas that expands and contracts with temperature.
- Edge delamination — adhesion loss that often starts at unprotected or poorly sealed edges under cyclic strain.
- Internal fracture of glass — less common from cold alone, but worth logging when samples crack during recovery.

Ionoplast interlayers are chosen for high modulus, strong adhesion, and post-break retention. Those properties help cold-climate façades and skylights stay safe after glass breakage. They do not cancel the need for sound lamination process control and edge detailing—especially when panels face outdoor cycling for decades.

CNCGLASS · A practical lab simulation outline

Plant QA and third-party labs use many climate profiles. One clear, repeatable outline that fabricators can discuss with their lab—and that aligns with severe winter simulation thinking—is:

Step	Target practice	Why it matters
Cool	About 2 °C per minute down to −20 °C	Avoids thermal shock artifacts while reaching a harsh winter set-point
Hold	24 hours at constant −20 °C with logged temperature	Gives dwell time for adhesion and moisture effects to appear
Recover	Slow return to room temperature	Mirrors natural warming; abrupt jumps can create unfair stress
Rest	About 30 minutes at room temperature before the next freeze	Stabilizes the sample between cycles
Repeat	Multiple full cycles (for example ten) with inspection after each	Builds confidence beyond a single cold soak

Use panels and film from the same production logic you intend to ship. Log chamber temperature continuously during the hold. Treat the outline as a severe screening protocol—not a substitute for project-specific climate standards your consultant or authority may require.

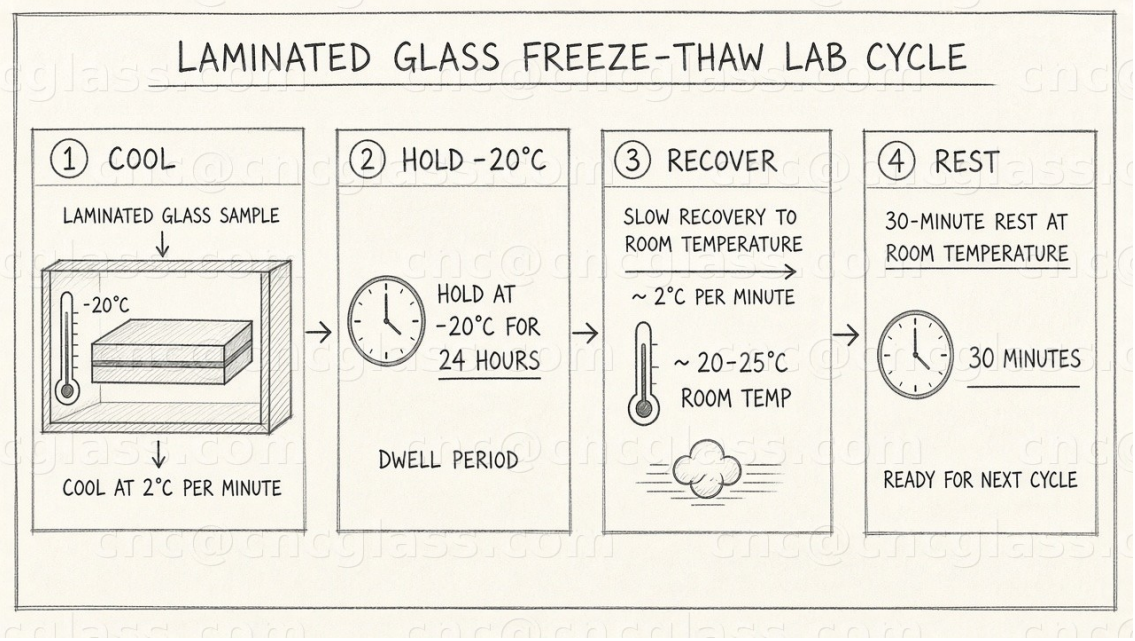


Figure 1 — Example freeze–thaw lab cycle for laminated glass: controlled cool to −20 °C, 24-hour hold, slow recovery to room temperature, then a short rest before the next cycle.

CNCGLASS · Inspection after every cycle

Optics and edges tell the story before mechanical tests do. After each recovery and rest, examine every sample under good lighting against a dark and a light background:

- Delamination — edge lift, silvering, or progressive separation along the perimeter.
- Bubbles — discrete voids, clusters, or growing pockets inside the view area.
- Fogging — diffuse haze, milkiness, or moisture-like clouding in the interlayer plane.
- Other notes — cracks, discoloration, edge seal distress, or frame interaction if the coupon is framed.

Photograph defects with scale references. Record cycle number, sample ID, and whether the defect appeared during cool, hold, or recovery. Early edge haze that does not grow may be process residue; progressive fogging or bubble growth is a stop-and-investigate signal for film moisture, vacuum integrity, autoclave/bag parameters, or edge protection.

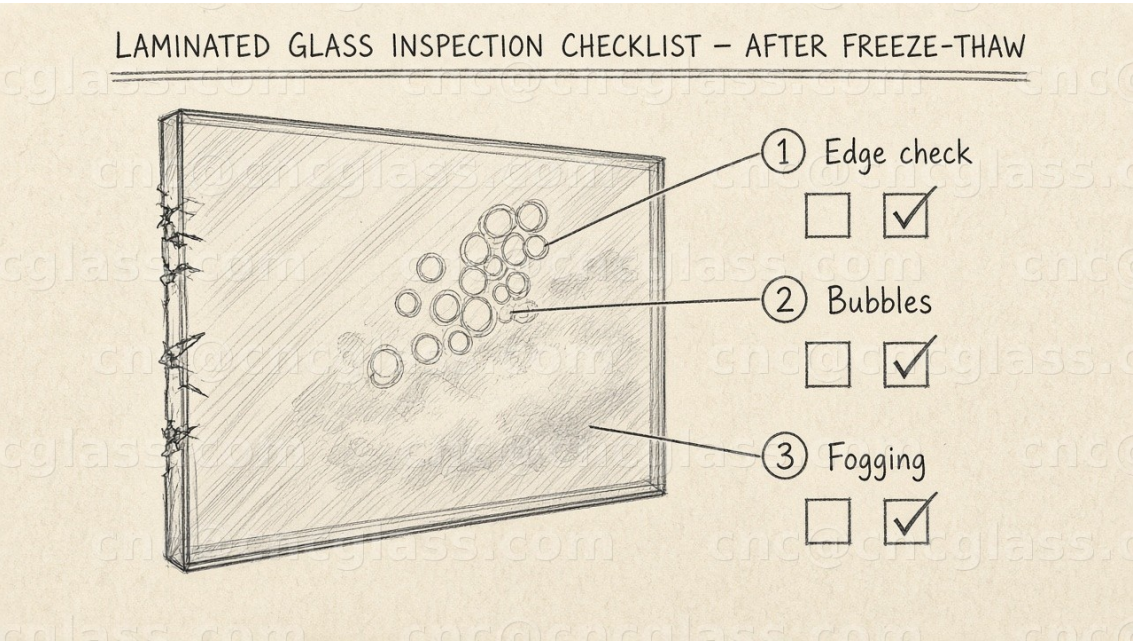


Figure 2 — After each cycle, inspect for edge delamination, internal bubbles, and interlayer fogging or haze before residual adhesion testing.

CNCGLASS · Residual adhesion: pummel after cold cycling

Passing visual checks is necessary but not enough for safety glass. After the planned cycle count—and only if optics remain acceptable—run a residual adhesion / pummel-style evaluation consistent with your plant's safety-glass practice. Look for retained bond: high adhesion levels with limited exposed interlayer area after impact of the broken glass against the film.

As a practical benchmark language used in many laminated-glass labs: strong ionoplast laminates after severe cold cycling should still show high pummel ratings (for example Level 8 class performance) with only a small fraction of interlayer area exposed (commonly discussed near the under-5% range when adhesion is excellent). Always follow your own documented method, sample size, and acceptance criteria—do not import a number from another plant's report into a project specification without aligning the test method.

Check	Pass-oriented reading	Investigate if...
Clarity after N cycles	Still transparent; no progressive haze	Fog appears or worsens with cycle count
Bubbles	None new; none growing	Voids expand on recovery or hold
Edges	No lift or silvering progression	Perimeter separation advances
Pummel / adhesion	High retention; low exposed film area	Bond collapses after cold cycling

CNCGLASS · Why ionoplast fits cold façades and skylights

CNCGLASS positions stiff ionoplast (SGP-type) interlayers for structural and safety laminates where residual panel integrity matters after breakage—curtain walls, skylights, canopies, high-altitude terminals, and alpine public buildings. Cold climates add freeze–thaw to wind and snow load. A high-modulus ionoplast helps the cracked laminate act as a stiff membrane in the frame instead of sagging into a soft bag of glass.

- Northern alpine façades and punched openings with large day–night swings.
- Skylights and roofs that see snow load, meltwater, and repeated freeze lines at edges.
- Airport, station, and civic canopies in high-altitude or continental winter zones.
- Safety laminates where post-break retention must survive winter service, not only lab impact at room temperature.

Cold performance still depends on dry film handling, correct layup, vacuum and heat/pressure windows, edge sealing where the design requires it, and framing that does not force water into the interlayer plane. Film chemistry cannot rescue chronically wet edges or under-degassed stacks.

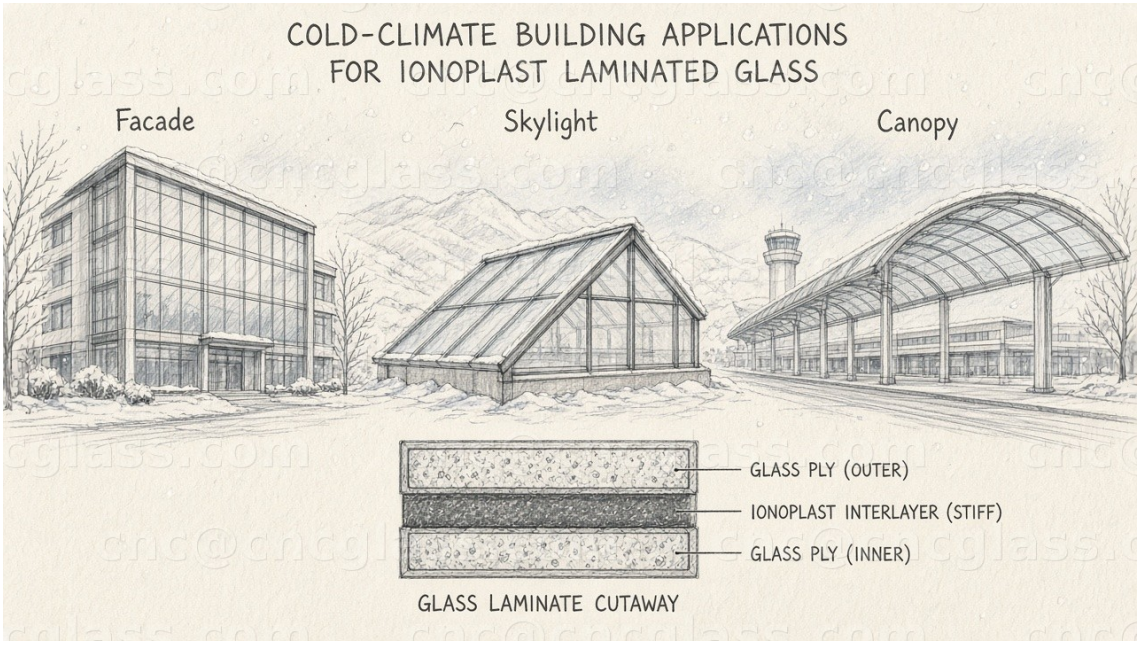


Figure 3 — Cold-climate roles for stiff ionoplast laminated glass: façades, skylights, and canopies where freeze–thaw and residual safety matter together.

CNCGLASS · Process and detailing that protect cold-cycle results

Film storage and layup dryness

Store ionoplast film per CNCGLASS guidance—sealed packaging, controlled humidity, FIFO use. Condensation on cold glass or damp film is a classic path to haze that later looks like “freeze–thaw fogging.”

Degassing and bonding

Follow validated vacuum-bag or autoclave recipes for the glass thickness and interlayer gauge. Incomplete air removal shows up later as bubbles that pulse with temperature.

Edges and weather seals

Protect exposed edges with compatible sealants and framing details that shed water. Freeze–thaw at a wet edge is far more aggressive than dry cycling of a well-bonded interior coupon.

Sample realism

Coupon size, edge finish, and whether samples are framed should reflect the product you sell. Tiny perfect lab squares can pass while production-size edges fail—design the check accordingly.

CNCGLASS · What CNCGLASS can support

CNCGLASS supplies ionoplast and EVA interlayer materials and process coaching for B2B laminators. For cold-climate programs, share glass schedules, interlayer gauges, edge conditions, target climate zones, and any lab protocol your consultant already named. The team can then align film selection, sample rolls, and process windows—not a one-line weatherproof claim without engineering context.

- Ionoplast interlayer direction for structural and safety laminates in cold regions.
- Discussion of freeze–thaw screening outlines and inspection language for plant QA.
- Coordination with EVA options where adhesion, inserts, or process fit call for EVA instead of ionoplast.
- Export packing and technical dialogue for international fabricators.

CNCGLASS · Conclusion

Repeated freeze–thaw is a legitimate risk lens for laminated glass in extreme cold—but it is manageable when ionoplast adhesion is sound, lamination is dry and fully degassed, edges are protected, and QA includes cycle-by-cycle optics plus residual adhesion testing. CNCGLASS frames stiff ionoplast laminates as a strong candidate for cold façades, skylights, and public canopies precisely because residual stiffness and bond strength matter after glass cracks in winter service. Contact Peter Lin in Shenzhen to align film and process with your cold-climate laminated glass program.

CNCGLASS · FAQ

Q1: Will ionoplast laminated glass fog after freeze–thaw?

A: Well-bonded, dry ionoplast laminates are designed to stay clear through severe cold cycling. Fogging usually points to moisture, process residues, or edge water paths—not to cold temperature by itself.

Q2: Can freeze–thaw create bubbles in SGP-type laminates?

A: Temperature cycling can enlarge or reveal voids left by incomplete degassing or vacuum faults. Strong process control reduces that risk; cold alone does not invent gas from a fully bonded stack.

Q3: Does freeze–thaw cause delamination?

A: Progressive edge separation after cycling signals adhesion or edge-protection problems. High-quality ionoplast bonds with protected edges are expected to resist repeated cool–hold–recover sequences used in severe screening.

Q4: What cold cycle should a plant run?

A: Agree the profile with your lab and project requirements. A severe example is cool at about 2 °C/min to −20 °C, hold 24 hours, recover slowly, rest about 30 minutes, then repeat with inspection each cycle. Project standards may differ.

Q5: Why check pummel adhesion after cold cycling?

A: Winter service still needs post-break safety. Visual clarity after cycling does not prove the glass–film bond still meets your safety retention target—pummel or equivalent adhesion checks close that gap.

Q6: Where should ionoplast laminated glass be specified in cold climates?

A: Façades, skylights, canopies, and safety openings in alpine, northern, and high-altitude buildings where residual stiffness after breakage and long outdoor cycling both matter. Confirm stack, edges, and framing with the project engineer.

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