

Strain Pattern in Tempered and Heat Strengthened Glass

Strain pattern in tempered or heat strengthened glass is sometimes visible, usually on reflection, under certain polarizing lighting conditions such as a clear north sky or in sunlight reflected from glass at the necessary polarizing angle.

Strain pattern appears as an iridescent effect, which may be checkerboard, link chain, or more often in a multi-circular pattern related to the effects of the multi-nozzle (tube) air quench sections used in current horizontal roller hearth and automotive tempering furnaces. This multi-circular strain pattern is sometimes seen in reflected light from automobile backlights particularly when the observer is using polarized sunglasses or polarized clip-ons since polarized glasses permit only polarized light to pass and tempered glass acts as a partial polarizer.

Strain pattern, seen with certain lighting conditions, is a characteristic of all tempered and heat strengthened glass and cannot be considered a defect. Nothing can be done to eliminate this effect when the lighting conditions are present to observe it. Strain pattern is positive confirmation that the glass has been thermally strengthened.

The observation, under certain lighting conditions, of strain pattern in tempered or heat strengthened glass is due to an optical phenomenon known as birefringence. When visible light interacts with glass that has been thermally strengthened (tempered or heat strengthened glass), the light waves will travel at different velocities in the X (width) and Y (length) directional axes of a glass plate. This optical phenomenon is termed birefringence. Birefringence occurs

because of the surface compression and center tension stresses that are introduced in glass by the tempering or heat strengthening process. In fact, birefringence is the property of strengthened glass that is utilized in optical instrumentation such as the DSR (Differential Surface Refractometer) and the GASP (Grazing Angle Spherical Polarimeter) which are used to non-destructively measure surface compression in tempered and heat strengthened glass.

Vitro (formerly PPG Industries) developed the DSR and GASP instrumentation and has licensed this technology to optical instrument manufacturing companies who provide this instrumentation to the glass fabrication industry.

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HISTORY TABLE		
ITEM	DATE	DESCRIPTION
Original Publication	March 1993	
Revision #1	1/15/2002	Transferred to TD-115
Revision #2	2016-10-04	Updated to Vitro Logo and format

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