Magic of microfloat

Process offers a more environmentally friendly alternative to traditional glass-ceramic manufacturing

By Karen Wegert

Commercial architects are demanding clear, transparent, smooth, distortion-free and environmentally friendly fire-rated glass-ceramic, because it offers more aesthetically appealing protection. The problem: it's an incredibly difficult and energy-intensive product to make.

Schott,with U.S. offices in Louisville, Ky., has found a solution. The company is using an innovative glass-ceramic manufacturing process – called the microfloat process – to produce clear, colorless, transparent and wireless fire-rated glass-ceramic with a smooth, distortion-free surface. This fire-rated glass-ceramic, Schott Pyran Platinum, is the only glass-ceramic in the world produced using this microfloat process.

How do they do it?

The unique microfloat process was born out of the microfloat melt tank at Schott Technical Glass Solutions GmbH in Jena, Germany. Schott's microfloat tank differs from common soda lime float tanks in both size and process capability. The microfloat tank, as the name implies, has a smaller output of 20 tons to 50 tons per day compared to large soda lime float tanks, which can produce 400 tons to 1,000 tons per day. However, this smaller output enables the tank to operate at much higher temperatures and create more customized glass-ceramic solutions.

Standard glass-ceramic manufacturing consists of six major processes: melting the raw materials into liquid glass, forming the glass into a flat plate, annealing the glass to remove stress, cutting the glass into separate sheets, ceramizing the glass to form an ordered crystal structure, and cutting the glass into appropriate glazing dimensions. The manufacture of Pyran Platinum through the microfloat process begins in much the same way. Raw materials, such as refined sand and re-used glass cullet from previous glass-ceramic melts, are combined to increase the yield and reduce the required energy input. This raw material batch is then fed continuously into a melting tank.

Figure 1: The smooth, distortion-free surface of Pyran Platinum floated glass-ceramic fire-rated glazing manufactured using the microfloat process at Schott Technical Glass Solutions GmbH in Jena, Germany, is evident in this photo of the formed glass ribbon.

In the Pyran Platinum process, however, the raw materials for the parent glass are then optimized to create the desired end-product attributes of the ceramized glass-ceramic, including near-zero thermal expansion, high thermal shock resistance and high temperature resistance — critical to fire-rated glazing.

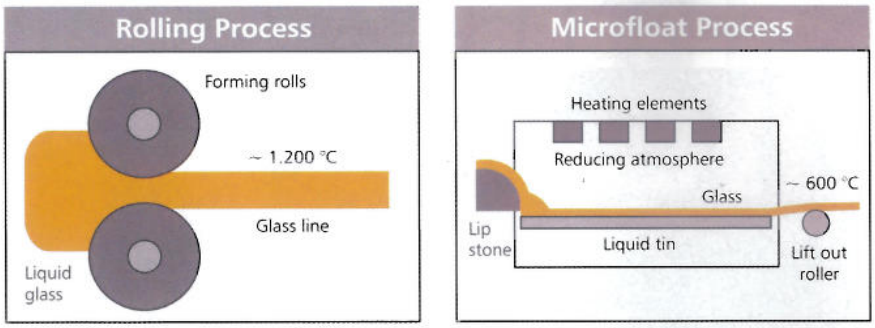
Schott also has developed special decolorization agents that improve the color of the glass, which are added to the composition of its Pyran Platinum product. Certain raw materials in traditional glass-ceramic melt tanks discolor the glass, giving it an amber tint. It is impossible to view the true color of an object through an amber-tinted window. This is a problem in office buildings and hospitals, and especially in museums, libraries and historic buildings. Schott's decolorization agents, however, enable the manufacture of a product that more closely matches the color of common window glass.

After the raw materials are combined and fed into the melting tank, the melt is heated to temperatures far higher than those used for common soda lime melts: 200 degrees Celsius or higher. The hot liquid glass mixture is then refined to remove bubbles and impurities. From the melt tank, the molten glass then flows into the microfloat tank.

Inside the microfloat tank, a molten glass ribbon floats on a bath of liquid tin. The liquid tin does not mix with molten glass and allows the glass to spread out to a uniform thickness. The temperature of the glass is then slowly decreased by 600 degrees Celsius. This slow cooling enables the surface of the glass to remain smooth with a high quality mirror finish because rollers and other mechanical parts do not come into contact with it (see Figure 1).

The smooth, flat glass ribbon is then pulled from the float bath into the annealing furnace. There, the residual stresses introduced during the forming stage

Rolling Process vs. Microfloat Process



▶ A rolled glass has a textured surface caused by the forming rolls

▶ Due to the microfloat process the glass has a mirror like surface quality

Figure 2: A graphical representation of the differences between the traditional rolling process and the microfloat process.

are released, and the glass is cooled even more at a slow, controlled rate. The glass is then cut into sheet sizes and is ready for ceramization, where it is transformed from a glass into a glass-ceramic.

Traditionally, the forming step of glass-ceramics manufacturing is accomplished by a continuous flow of molten glass out of the melt tank through a nozzle between rollers (see Figure 2). The distance between the rollers determines the thickness of the glass ribbon. This traditional rolling process results in surface imperfections in the finished glass-ceramic glazing product. Contact with the rollers leaves slight to moderate imprints in the finished glass surface, similar to the imprints in an orange peel. These slight surface imperfections cause distortion when looking through a finished window. The distorted glass-ceramic surface can be smoothed to remove the roller imprints, but only by an energy-intensive polishing process.

Traditional glass-ceramic manufacturing also requires that hazardous heavy metals — such as antimony, arsenic and barium — be added as refining agents in order to remove bubbles. Schott has developed alternative refining processes for Pyran Platinum glass-ceramic that do not require hazardous heavy metals. That means fewer heavy metals are ending up in landfills at the end of a product's life. And it means a healthier environment for the people who work around the microfloat tank and the products that it creates.

The resulting Pyran Platinum glass-ceramic is fire-rated up to 90 minutes in windows and up to 180 minutes in doors, passes all required fire endurance and hose stream tests and is more environmentally friendly than traditional fire-rated glass-ceramics. It was recently granted "cradle-to-cradle" certification by MBDC, or McDonough Braungart Design Chemistry LLC, because of its material content, recyclability, and manufacturing characteristics. This certification qualifies products for a special credit in the Leadership in Energy and Environmental Design Green Building Rating System.

Resources

Pyran Platinum fire-rated glass-ceramic is available through distributors such as General Glass International, Secaucus, N.J.; Glassopolis, Toronto; Interedge Technologies, Sausalito, Calif.; and Safti First, San Francisco.

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