



GLASS UNLIMITED

Technical Information – 09/2010

Risk of Nickel Sulfide presence in glass

Origin

Glass can contain inclusions of various natures, coming from the raw materials, cullet or from the production facilities themselves. Among these, we find the Nickel Sulfide (NiS). These inclusions have a size of about 80 μm to 500 μm . They have the distinction of having a different crystalline structure at low and high temperature so that their volume is greater at low temperature.

Phenomenon

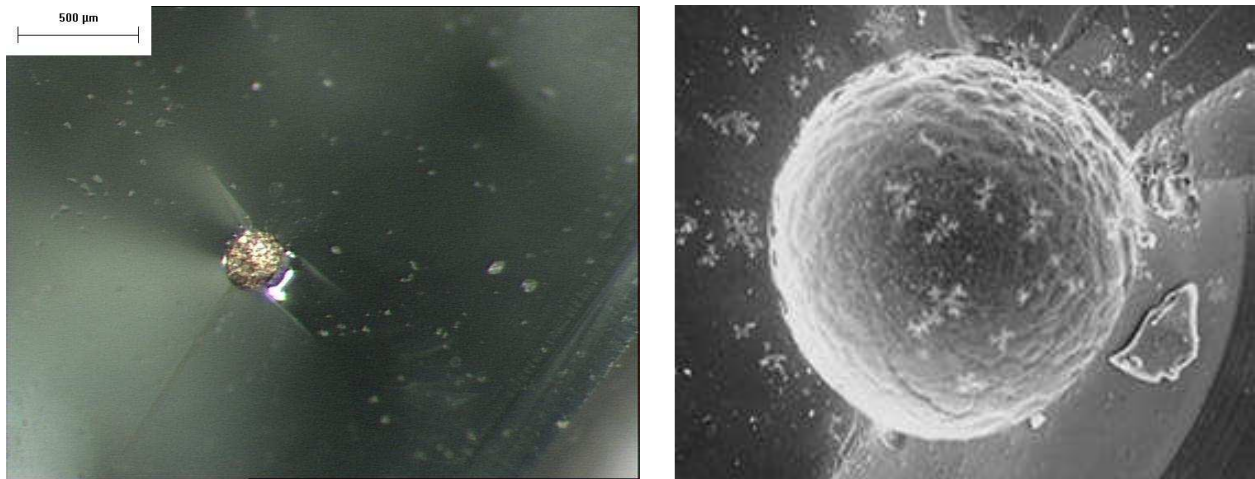
If the glass undergoes a slow cooling (case of annealed glass), all particles of NiS have the time to reach their structure at low temperature during the cooling of the glass. The change in volume of inclusions can be absorbed by the still "soft" glass and they do not present a danger to the glass.

But, in the case of thermally toughened glasses, NiS reaches its stable structure at high temperature at the beginning of the operation of tempering when temperature of the glass is about 650°C. The rapid cooling which follows does not leave time to NiS to reach its stable structure at low temperature before glass is not entirely solidified. Its transformation will therefore continue at the temperature of service of the glass and the related increase in volume can cause spontaneous breakage of the glass sheet.

In this case, we find a characteristic breakage in the shape of butterfly. Many articles and publications exist on the subject. The phenomenon is inherent to thermally toughened glass, and can therefore not be considered a hidden defect of the product.



Typical breakage starting from a NiS inclusion



Zoom on a NiS inclusion

These ruptures remain not very frequent, but can affect a certain number of thermally toughened glazings of a building. The probability of breaking increases when the surface and the thickness of the glazings are more important.

Prevention

In order to limit the risks of spontaneous breakage, two solutions exist.

1°) If a safety glass is not necessary for your application, we can replace the thermally toughened glass by heat strengthened glass (according to EN 1863) which does not present the risk of spontaneous rupture.

2°) If the thermally toughened glass is necessary, a process called “heat soak” can be achieved. This one consists in placing glass in a furnace at a stage of temperature, during a determined time, in order to enable and accelerate the transformation of NiS. The rupture due to the possible presence of critical particles of NiS will occur during this treatment.

The "heat soak" method (rise in temperature, duration ...) is described in standard EN 14179.

Conclusion

When using thermally toughened glass, a risk of spontaneous breakage due to the presence of nickel sulfide particles is possible. This problem can be avoided using heat strengthened glass or thermally toughened glass with complementary "heat soak" treatment.

It is necessary to specify, when ordering heat treated glass, if it must be heat strengthened (EN 1863), thermally toughened (EN 12150) or “heat soaked” thermally toughened (EN 14179).

In the case of use in structural components (bolted glass, beams ...), all glasses must undergo this treatment