

External over-coating of the glass bath

Michael Horsfield considers the application of external over-coating to the furnace glass bath and the need for continuous monitoring.

During the campaign life of a furnace, either designed or extended, it is inevitable that external over-coating of the melting end glass bath will be required at some stage. This may be due to varying factors, including:

- The severity of the internal wear profile of the refractory material at metal level.
- An abnormal wear characteristic of the refractory.
- An abnormal internal wear pattern of the refractory.
- Cracking of the refractory.
- Open joints of the refractory blocks.
- Operation of installed equipment, ie electric boost and bubbler systems.
- Added security and peace of mind for an extended furnace campaign life.

The over-coating process can either be planned and listed under the category of 'proactive maintenance' or unplanned, which can be listed under the category of 'the unexpected' or 'firefighting maintenance'.

OVER-COATING CATEGORIES

Varying observed conditions of the existing glass bath refractory will dictate the type and requirements of the external over-coating needed. Types of external over-coating are typically as follows:

Metal line over-coat: During the furnace campaign life, the metal line wears continually with time, at rates that can be variable throughout this period, due to changes in glass output, batch feed characteristics, the efficiency of air and in some cases, water cooling systems, refractory exudation and refractory corrosion.

Because of this wear, the metal line of the glass bath soldier (or sidewall) blocks becomes hot and thin. This, in turn, causes cracking in several directions, forming pieces



Positioning of metal line over-coat tiles.

which can be pushed outwards with the pressure of the glass behind them.

To prevent glass leakage and unexpected breakage of the refractory, the position is externally over-coated.

Sectional metal line over-coat:

On occasion, a section of the metal line may wear internally more than other areas, creating increased wear at one local position in comparison to the rest. This condition may be caused by batch pile flow characteristics, refractory block

coat: This position of the glass bath is considered a high wear area, due to the batch feed patterns moving into the melting area. The abrasive nature of the batch gives cause to constant extensive internal wear at the metal line of the doghouse corner soldier (or sidewall) blocks, potentially creating an increased wear position in comparison to other areas of the glass bath.

Although the doghouse corner glass contact refractory is normally a harder wearing type of refractory to that of other soldier (or sidewall)

“Typical over-coat life is between 12 and 18 months, depending on materials used, cooling systems and furnace operation”

quality and external cooling systems inefficiency, or a combination of these phenomena. When this condition occurs, the relevant local length of the metal line is over-coated.

Full height soldier (or sidewall)

block over-coat: Due to a given furnace campaign life known to exceed that recommended for the glass contact material given by the supplier and the assessment of glass leakage risk for a further required campaign life period, consideration may be given to over-coat the full height of the glass bath perimeter.

This type of over-coat will give added security, helping to prevent unexpected glass leakage for a short extended furnace campaign life.

Sectional full height soldier (or sidewall) block over-coat:

Intermittent excessive internal wear may occur at local areas of the glass bath for several reasons, including varying glass convection currents, positioning of electric boost systems, quality of refractory and production variations among others. When this condition is detected, the relevant local area of the glass bath is over-coated for the full height of the soldier (or sidewall) block.

Doghouse corner block over-

coating, there may be a requirement, during a given furnace campaign life to over-coat the position to give added security.

Throat over-coat: For reasons encountered during the campaign life of a furnace, it may be a requirement to over-coat the throat refractory, in order to give security against possible glass leakage. Such a requirement may be triggered by the observation of hot refractory, glass seepage into block joints and block cracking.

Bottom over-coat: Certain observed glass bath bottom conditions, including hot refractory, cracking of electrode and bubbler blocks and glass leakage may give cause to over-coating a local position to prevent an adverse condition and aid structural stability during a given furnace campaign life.

Most repairs to the furnace glass bath are carried out to the external surface of the existing materials, as they are required to be executed while the furnace is in operation.

However, certain repairs may be necessary where a partial drain of the glass is required, with minimum non-productive time experienced and a full drain of the glass and controlled cool down of the furnace being needed. ➤



Bubbler block over-coat tile supported in position.

HEALTH AND SAFETY

The work requirement in each category can be high risk, potentially dangerous to personnel, with the added possibility of a refractory structure being unstable in part or total. Consequently, it is essential that a detailed work and health and safety plan is created prior to any work taking place, to minimise risks to personnel and possible instability of any refractory structures.

Although not exhaustive, this detailed plan should allow for the following:

- Selection of the correct disciplined work team.
- Identification of the main communication contacts and links.
- Selection of the correct 'fit for purpose' materials to be used for the repair.
- Fully described work plan.
- Detailed method statement and corresponding risk assessment.
- Check of the site work area, using an itemised checklist.
- Identification of who should be advised of what and when, including any duties required from third parties.

CONSIDERATIONS

There are several important factors to consider prior to the external over-coating of the glass bath, in order to assess any risks that may be encountered both during the work execution phase and after, including:

- Time for over-coating - For proactive maintenance over-coating, it is essential to choose the correct time to introduce the over-coat in respect of the required furnace campaign life.

- The present steelwork support and bracing design - There may be a need to introduce temporary bracing steelwork to give optimum bracing characteristics during over-coating.
- Should the glass be totally or partially drained from the furnace? - Depending on the nature of the over-coat, it may be necessary to remove the glass from the furnace, either in total or in part. This is a critical topic as draining of the glass may reduce the risk to working personnel but create collapse of the soldier (or sidewall) blocks, depending on their age and condition.
- Removal of refractory backing materials - In order to install the over-coat blocks or tiles correctly, the removal in total or part of the refractory backing materials to the glass bath soldier (or sidewall) blocks will have to be carried out.
- Access parameters - Observation of the access to allow for the over-coating materials to be installed should be investigated.
- Installation techniques - Seating of the over-coat materials should, where possible, be tight against the primary refractory and should not be placed directly on top of the backing or supporting materials to the primary refractory.
- Over-coat materials - The chosen over-coat materials should be compatible with the hot face refractory material, the correct thickness for the application (generally 75mm thick and supplier's standard size) and relevant to the type of

glass being produced with respect to any possible contamination.

- Steelwork bracing design - The original steelwork bracing design may have to be modified to accommodate the over-coat materials.
- Over-coat life - A typical over-coat life is between 12 and 18 months, depending on materials used, cooling systems and furnace operation, before additional work may have to be carried out, ie a second over-coat if parameters will allow in order to realise a possible required extension to the furnace campaign life.
- Potential future problems - When over-coating materials are installed, it is likely that an insulating effect to the primary refractory is created and this refractory will be lost at the high wear and thin material positions. Because of this condition, local hot spots may be experienced at the sides, bottom or top of any partial over-coat area.

MONITORING

The nature of the over-coating process introduces differences to the design and internal wear characteristics of the glass bath primary refractory. This, in turn, may give cause to variable wear of the over-coat refractory, creating hot spots at local positions and possible glass seepage at block or tile joints.

To reduce risk and help identify problems before they happen, it is recommended that monitoring of all over-coated areas is put in place. This monitoring should be carried out by relevant departmental personnel and also by an external body to achieve maximum effect.

“Over-coating of the glass bath primary refractory can retain a particular encountered problem and extend furnace campaign life.”

CONCLUSION

Over-coating of the glass bath primary refractory can retain a particular encountered problem and extend furnace campaign life. However, it can also introduce added complications if the over-coated positions are not monitored on a scheduled basis.

Prior to any over-coating, it is essential that its requirement, the identified scope of work, implementing the required scope of work and future requirements are discussed in detail by relevant company personnel and any invited external party.

Because of potential problems that the process of over-coating may create, it is essential that regular monitoring is introduced into a maintenance programme. This will achieve a proactive approach, help identify potential hazards at an early stage and eliminate the need for firefighting maintenance. ■

ABOUT THE AUTHOR:

Michael Horsfield is Managing Director of DISMATEC

FURTHER INFORMATION:

DISMATEC Ltd, Sheffield, UK
 tel: +44 114 279 2618
 email: info@dismatecglasplant.com
 web: www.dismatecglasplant.com