Collage of Engineering

Materials Department

Third Class

Lecture (5-a)

GLASS

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The ***hot end*** of a glassworks is where the molten glass is formed into glass products, beginning when the batch is fed into the furnace at a slow, controlled rate by the batch processing system (batch house). The furnaces are **natural gas** or **fuel oil** fired, and operate at temperatures up to 1,575 °C (2,867 °F). The temperature is limited only by the quality of the furnace's superstructure material and by the glass composition. Types of furnaces used in container glass making include '**end-port**' (end-fired), '**side-port**', and '**oxy-fuel**'. Typically, furnace "size" is classified by metric tons per day (MTPD) production capability.

The batch is introduced in the furnace at high temperature, and the energy provided to the batch is used to convert the batch into a glass melt. The **batch-to-melt conversion** implies a series of chemical reactions (decarbonation, dehydration, solid-state reactions, formation of low-melting eutectics, dissolutions)

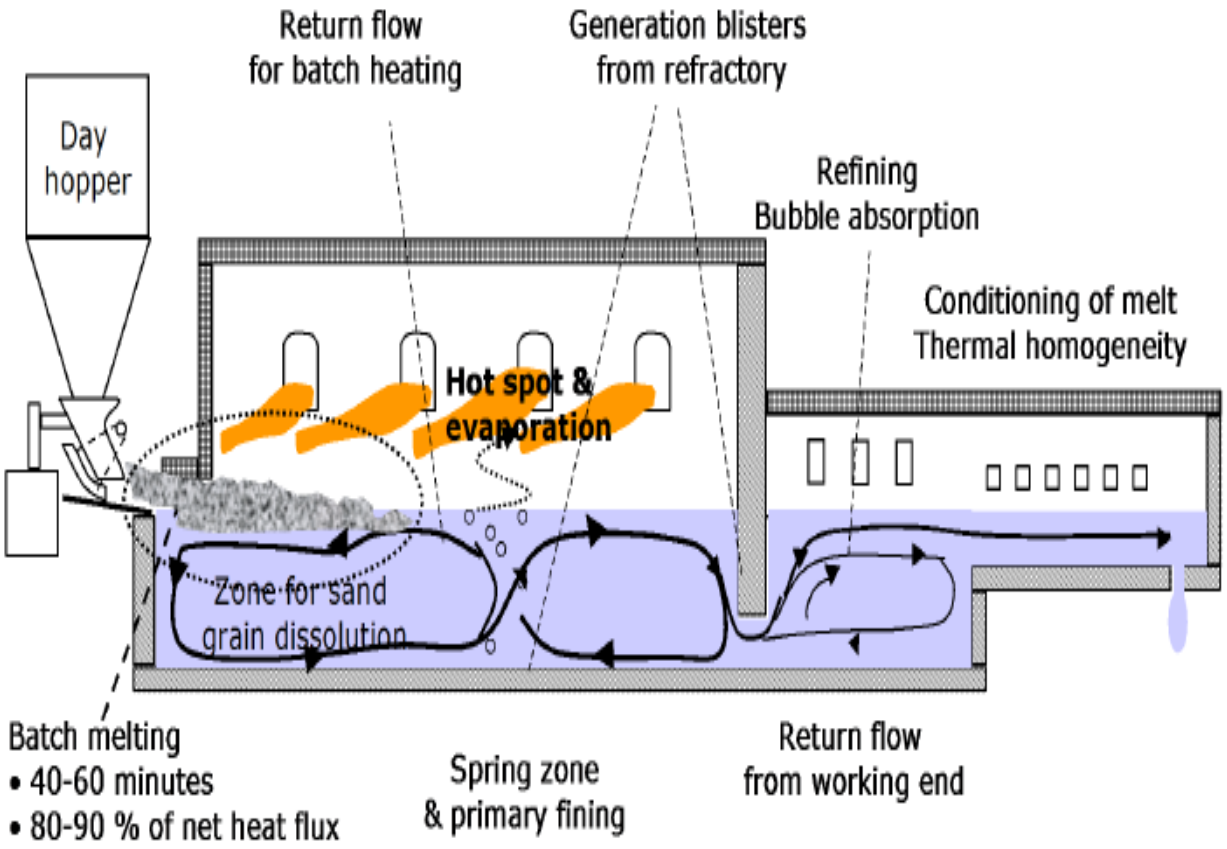

Figure (4.1)Schematic of an industrial glass melting tank

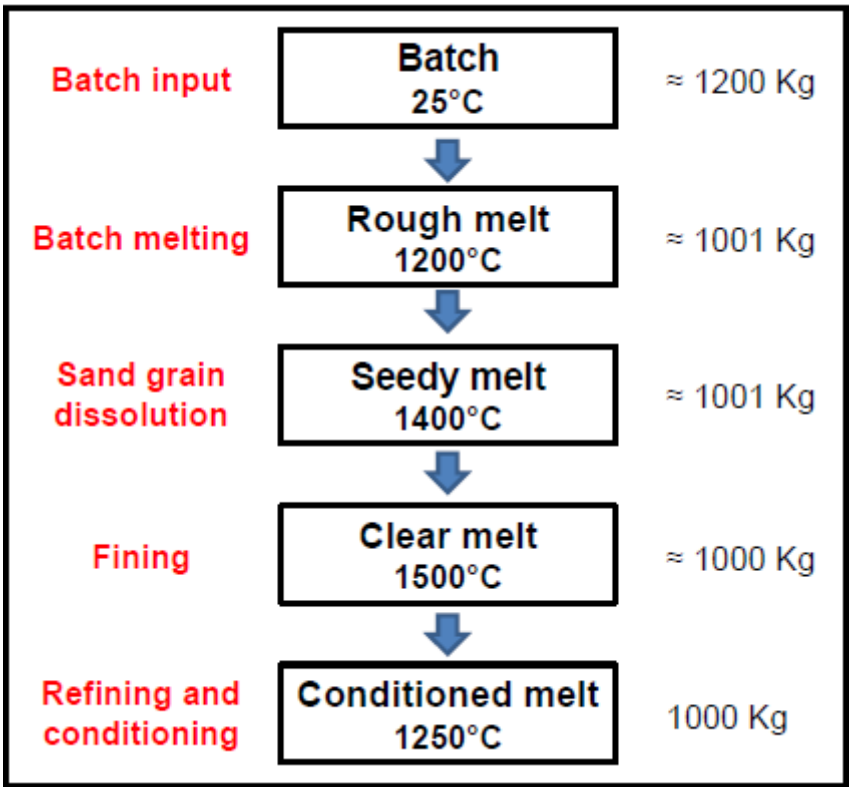

Figure (4.2) Melting and fining in the furnace

4-2-1 release of gases

Initial heating of a glass forming batch usually results in the release of some moisture, which may have been absorbed on the particles or combined as water of hydration or as hydroxyl. The temperature at which this water is released will depend upon the nature of its bonding to the materials, i.e., **physical** or **chemical** and the strength of these bonds. Removal of this water carries heat from the batch and increases the cost of processing.

Gas is released during the decomposition of carbonates, sulfates and nitrates. The gases released expand to volumes much greater

than that of the starting batch, resulting in considerable mixing and stirring action, which aids in homogenization of the melt. The creation of so much gas, however, also leads to the formation of an extremely large number of bubbles, which must be removed from the melt before processing is completed.

The rapid formation of a liquid can entrap a portion of the air which initially occupies the space between particles and result in bubble formation. Rapid heating of such a melt can lead to expansion of these bubbles and foaming of the melt.