IESL Industrial Visit to Piramal Glass Ceylon Factory, Horana

The Civil Engineering Sectional Committee of the Institution has organized the above visit on June 22, 2019.

Ceylon Glass Company Plc incorporated in 1955, recently changed its name to **Primal Glass Ceylon**. Piramal glass has global footprint with manufacturing facilities located in USA, Sri Lanka and India. Piramal glass Ceylon is located at Wagawatta road, Poruwadanda, Horana.

Glass is often a transparent material that has widespread practical, technological and decorative uses, such as, window panels, packaging (container), tableware and optoelectronics. Glass is known to be a non-crystalline and amorphous solid. Piramal is a leading refine glass container manufacturer for alcoholic beverage, aerated bottles, food and beverage, pharmaceuticals, cosmetics and perfume industry. They don't make sheet glass.

Mainly piramal can make 2 types of glass, flint type (Clear) and amber type (brown) using ingredients. Flint is a colorless glass which can be used to prepare colored glass, green, blue etc. The company has the capability of manufacturing glass containers having different shapes and colors with the sizes varying from 30 ml to 1.5 l. The factory has the ability to manufacture 300 Metric Tons of molten glass on an average per day.

The main raw materials are naturally occurring such as silica sand, dolomite, calcite, soda ash, feldspar, spodumene, and cullet (crushed glass). There are two types of cullet, internal and external. Internal cullet is composed of defective products that are rejected by quality control units during the manufacturing process and production offcuts. External cullet is waste glass that has been collected and reprocessed with the purpose of recycling

Composition of raw materials

Sand: The major chemical component of sand is silicon dioxide (SiO_2) and it is added as a network former in glass industry. The company has a sand production facility situated in Nathtandiya. Sand melts around 1700°C.

Soda ash: The major chemical component is Na_2CO_3 and is added as a network modifier and a fluxing agent. It is the second major component among the raw materials in

producing Sodium silicate glass (Soda lime glass). It has a melting point of 856°C.At temperatures above 800°C the silica will react with sodium carbonate as follows.

Dolomite: The major chemical component is $CaCO_3.MgCO_3$ and is added to introduce calcium and magnesium ions. The amount of calcium and magnesium controls the rms (relative machine speed) value in the production line.

Calcite: major chemical component is $CaCO_3$ and it is used as a network modifier and to control the amount of calcite without affecting the amount of magnesium in a batch.

Feldspar: The major chemical component is $KAlSi_3O_8$ and is mainly used as an Alumina source. Aluminum oxide formed in the melting process adds hardness, durability and resistance to chemical corrosion as a composite characteristic. Melts at 600°C.

Spodumene: The major chemical composition is $LiAl\ (SiO_3)_2$ and is added to reduce the viscosity of the glass melt. Reduction of the viscosity of the glass melt will increase the flow rate of the glass melt and thus will increase the rate of production. Moreover spodumene also acts as a fluxing agent.

Salt cake: The major chemical composition is Na_2SO_4 and is added as a fining agent and a fluxing agent. Melts at 600°C

The main sections in the manufacturing process:

The Batch House is where raw material is stored in large silos which would hold raw material sufficient for 1-5 days at all times, where by some batch systems include material processing such as raw material screening dying preheating etc. The system can be manual or automated, where the batch house measures, assembles mixes and deliver glass raw material recipe. However the batch recipe will differ depending on the type, color, quality design of the glass etc.

Cullet washing plant.

Hot End, basically the furnace, is where the molten glass is formed into glass products. These furnaces are natural gas or fuel fired and operates at temperatures Up to 1,575°C. There are types of furnaces used in Glass containers include " End port", " Side Port" and " Oxy fuel", and the furnace size is classified by Metric Tons per day production capability.

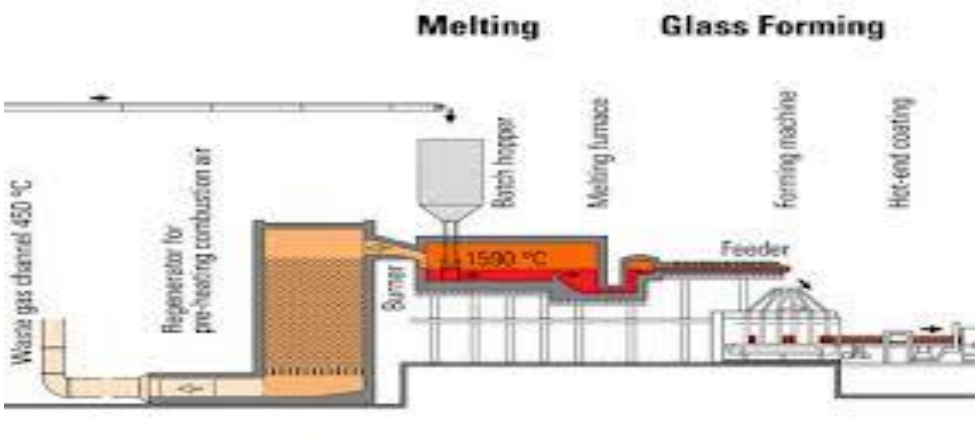
Furnace

There are primarily two methods of making glass containers. The Blow and Blow method used for narrow neck containers The Press and Blow method used for jars and increasingly narrow neck containers This is basically the forming process of the machines which then leads to the internal treatment process. At this stage the glass containers undergo a special treatment to improve chemical resistance specially to those intended to be used for alcoholic spirits, which is also referred to as de alkalization. Usually done through the injection of sulfur or fluorine containing gas mixture into bottles at high temperature. The next is the annealing process where it heats the bottle (to about 640°C) and cools it, not letting it to cool unevenly as it causes weak glass due to stress.

Cold End, this section would inspect the containers for visual defects, package and label the containers for shipment. Glass containers are 100% inspected which is done either through automated machines and manually. Common faults includes Small

cracks, foreign inclusions called stones , bubbles in the glass called "Blisters" and excessively thin walls.

Sketch of Manufacturing Process



Different type of glass products made by factory

Environmental protection measures and re use of wasted glass (Cullet)

Glass recycling is the processing of waste glass into usable products. Glass that is crushed and ready to be re-melted is called cullet.

Glass bottles and jars are infinitely recyclable. The use of recycled glass in manufacturing conserves raw materials and reduces energy consumption. Because the chemical energy required to melt the raw materials has already been expended, the use of cullet can significantly reduce energy consumption compared with manufacturing new glass from silica (SiO2), soda ash (Na2CO3), and lime (CaCO3). As a general rule, every 10% increase in cullet usage results in an energy savings of 2–3% in the melting process, with a theoretical maximum potential of 30% energy saving. Every metric ton (1,000 kg) of waste glass recycled into new items saves 315 kilograms (694 lb) of carbon dioxide from being released into the atmosphere during the manufacture of new glass.

Thankful to team leader and members of CESC for giving Engineers a valuable opportunity to visit Primal Glass Ceylon and wish them to a good service to the engineering profession through CESC.

(Written by Eng. J.M.C.G Jayasinghe)

Treasurer –CESC

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