Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firoza-bad

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firoza-bad/introduction

Introduction

Glass is a unique material for the expression of art and craft. Amongst all material, it offers the highest degree of flexibility for shaping into a wide variety of products varying in design, forms, color and appearance. Firozabad with the changing time has entered in to new era of glass manufacturing. It has become a major hub of glass products and has registered its global presence, diversifying its industrial base.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/place

Place

Firozabad is located in western Uttar Pradesh, 40 km from Agra, at the northern edge of the Deccan Plateau. It is a huge industrial base for glass manufacturing and provides employment to a lot of craftsmen in and around the city. Most of the units in the city run twenty-four hours. They use pot furnace, regenerative tank furnace or fully automatic furnace for making glassware. The first two use natural gas burners instead of coal and are made of firebricks. The product range includes bangles, bottles, plates, containers, bulb shells, toys, vases etc. These are made only on order. Half of the production of these industries is exported.

On the roads of Firozabad.

On the roads of Firozabad.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/place

On the roads of Firozabad.

On the roads of Firozabad.

Firozabad industrial area.

A glass factory in Firozabad industrial area.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/place

A glass factory in Firozabad industrial area.


A glass factory in Firozabad industrial area.


Bangle sellers outside the factory loading their carts.


Trash (glass bottles) that will be recycled.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/place

A glass factory in Firozabad industrial area.

A glass factory in Firozabad industrial area.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/people

People

The people of the city are a hard working lot. They work in the factories that are extremely hot and noisy. One can barely even hear the person standing next to him. Still, they go about their daily activities with ease and effortlessness. Usually men work in the factories and women back home. More than half the city's workforce is engaged in manufacturing activities. And the rest of them contribute indirectly to the chain by transporting, selling or buying the products.

Craftsmen enjoying a free ride.

Bangle seller.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/people

Craftsmen in the glass factory.

Bangle seller.

A worker transporting the glass products.

Craftsmen in the glass factory.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/people

Craftsmen in the glass factory.

Craftsmen in the glass factory.

Craftsmen in the glass factory.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process

Process

The most familiar type of glass used for centuries in windows and drinking vessels is soda-lime glass, composed of about 75% silica, sodium oxide, calcium oxide and several minor additives. For mass production, this type of glass is melted in large gas fired units. Glass is totally recyclable. There are different types of processes for making bangles, tableware (glass-blowing) and small items like toys, idols for worship etc. (glass-fusing).


Glass Blowing


Bangle Making


Glass Fusing

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Glass Blowing


Manual


Automatic

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing

Design Resource

Glass Work of Firozabad

The craft of glassware

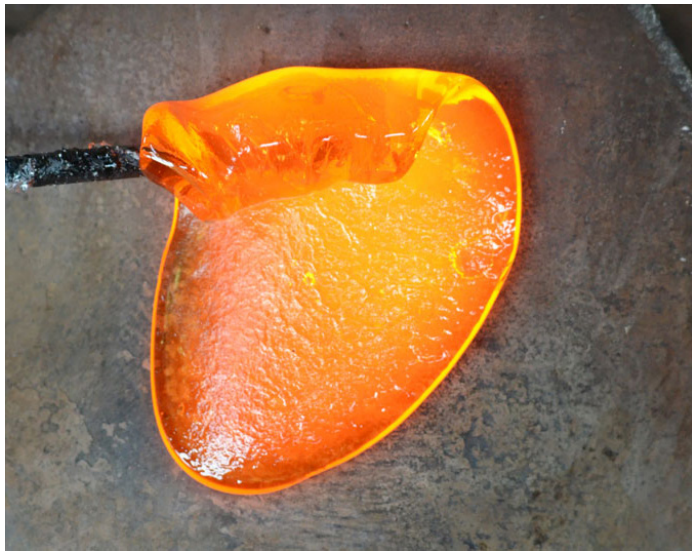
by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/manual

Manual

A stream of molten glass, at its plastic temperature (1050°C-1200°C), is cut with a shearing blade to form a cylinder of glass, called a gob. The process starts with the gob falling, by gravity, and guided into the blank moulds, two halves that are clamped shut. Akarigar blows air into the hollow pipe from the other end to make the glass take the shape of the mould. Water is sprinkled over the mould to cool it off after every piece. The vessel is then picked up from the mould and kept to cool. As glass cools, it shrinks and solidifies. Uneven cooling causes weak glass due to stress and break. For even cooling, these are kept into an annealing oven that heats the container to about 580°C then cools it. Similar process is followed for making plates too but the only difference is that air is not blown into the pipe to make the plate take the shape of the mould. Molten glass is pressed in between two metallic die plates.

Molten glass.



Molten glass.

Design Resource

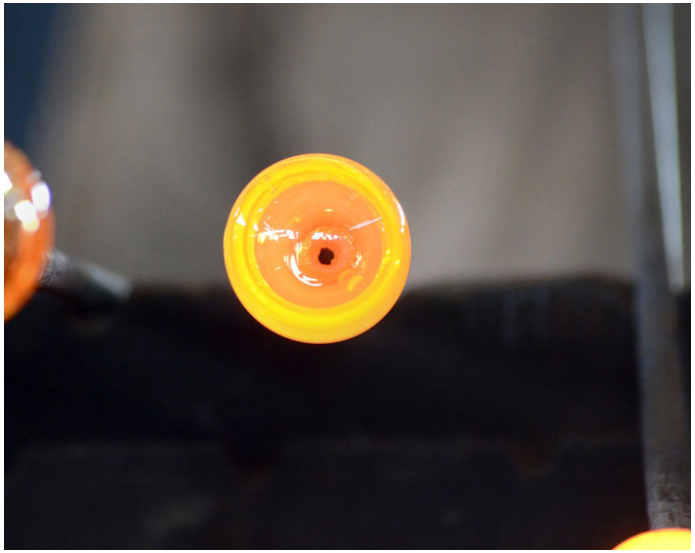
Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/manual

Gobs of glass.



Gobs of glass.

Air being blown from the other end of the hollow pipe.

Air being blown from the other end of the hollow pipe.

Design Resource

Glass Work of Firozabad

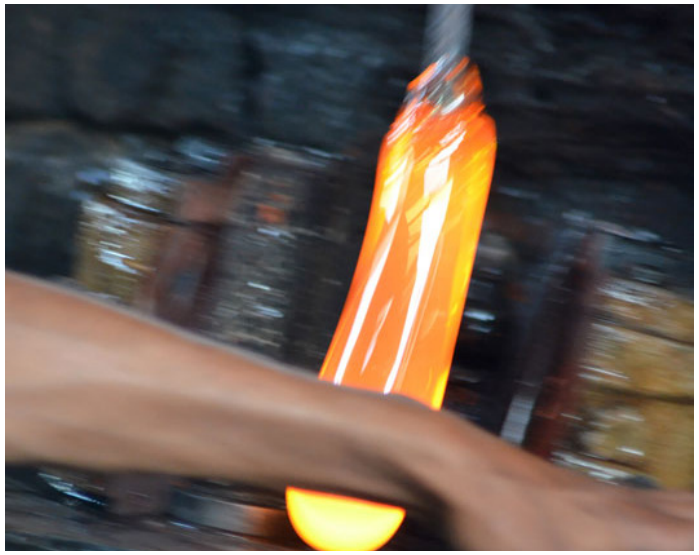
The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/manual

Gob falling by gravity.

Gob falling by gravity in the mould.



Gob falling by gravity in the mould.

Glass takes the shape of the mould while air is being blown from the other end.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/manual

Water being sprinkled to cool off the mould.

Glass takes the shape of the mould while air is being blown from the other end.

Mould being opened.

And the jar takes the shape of the mould.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/manual

The jar ready to be removed while another gob is introduced in the mould.

Bottles being cooled off.

Bottles being cooled off.

Bottles being cooled off.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/manual

Decorating the jar with glass frill.

Jars being cooled off.

Annealing oven that cools off the containers gradually.

Gob of glass.

Design Resource

Glass Work of Firozabad

The craft of glassware

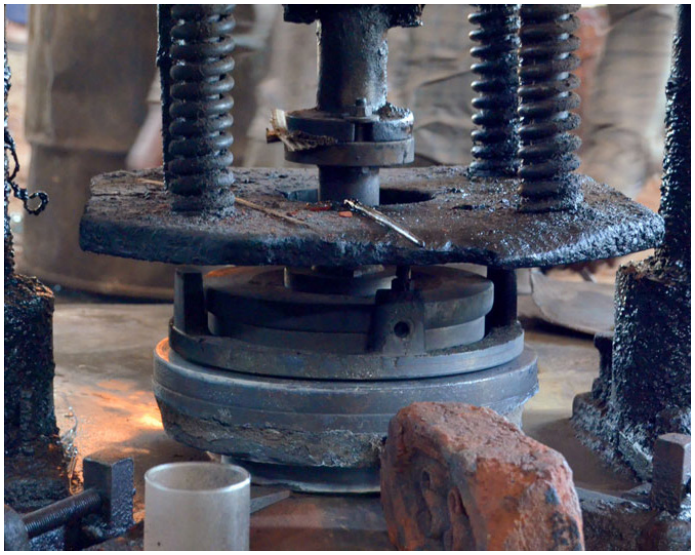
by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/manual

Stream of glass being put in the moulds.

Stream of glass being put in the moulds.

The moulds being pressed against each other to make the plate.



The moulds being pressed against each other to make the plate.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/manual

The plate takes the shape of the mould.

The plate takes the shape of the mould.

The plate takes the shape of the mould.

The plate takes the shape of the mould.

Design Resource

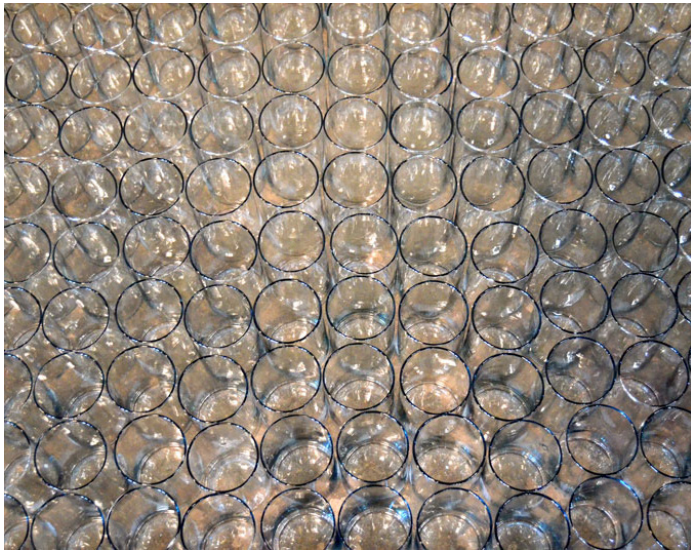
Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

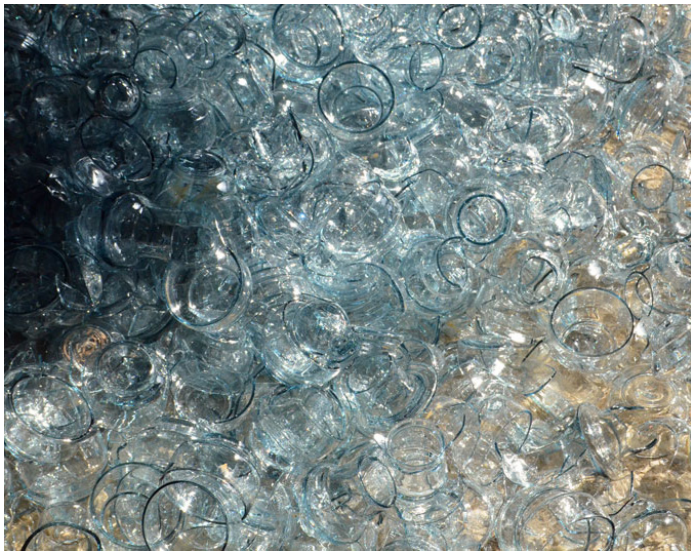
Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/manual

Ready plates.



Ready plates.

Rejected glass pieces to be recycled.



Rejected glass pieces to be recycled.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/automatic

Automatic

The glass shells of bulbs (that we use at home) are all made by the 'forming machines'. These are fully automatic. Generally powered by compressed air, the mechanisms are timed to coordinate the movement of all the parts of the machine. Silica is fed into the furnace once at the beginning and that keeps forming the molten glass that is the necessary ingredient for making any product. Temperatures controller monitors the temperature of each component of the machine. Once ready, the shell falls off gradually on to various conveyor belts of controlled temperature. The rejects of the entire process are put back into the furnace for recycling. One more quality check is done manually and the product is ready to be packaged and shipped.

Silica.

The exhaust fans in the factory.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/automatic

Pipelines in the factory.

The temperature control unit.

Pipelines in the factory.

The gas burners of the furnace.

Design Resource

Glass Work of Firozabad

The craft of glassware

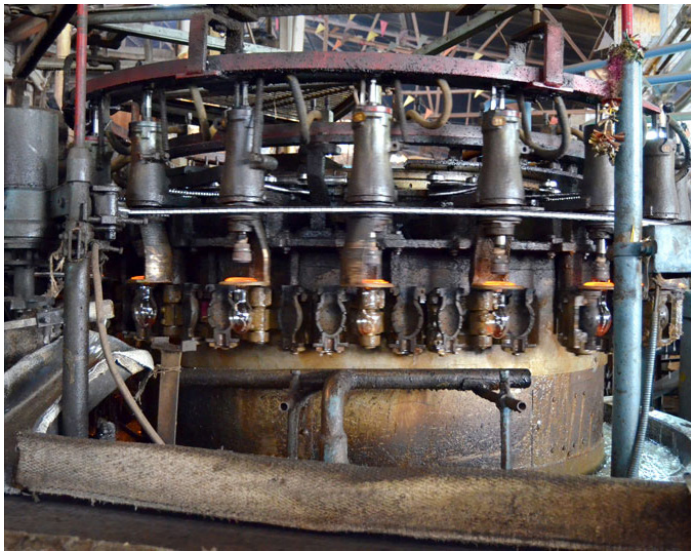
by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/automatic

Fan reducing the heat in the factory.

The automatic 'forming machine' making the glass shells.

The automatic 'forming machine' making the glass shells.



The automatic 'forming machine' making the glass shells.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/automatic

Conveyor belts to cool off the shell.

Pieces coming out from the annealing oven.

Glass shells.

Glass shell ready to be packaged.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-blowing/automatic

The packaging box.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/bangle-making

Bangle Making

Bangles are also made with soda glass. Coloring agents are added to the molten glass in the furnace. The craftsman gets this from the furnace on a metallic pipe and gives it to another. He puts a thin'taar' (wire) of this glass onto a rod that constantly rotates on a motor. So the thin glass coils around the rod and takes the shape of the bangle. These rods are of different diameters depending on the size of the bangle to be made. One more craftsman sitting at the other end of the furnace holds a big metallic ruler or a pointed tool that prevents the bangles from sticking with each other. When the entire rod gets filled up, the bangles are removed and another glass stream is added. The entire coiling process generates a long glass spring of sorts. This is cut using a diamond cutter. This is what separates each bangle from the other. Now since these are open ended and not complete circles, these are taken home by another set of workers to be finished. They melt the glass slightly to join the open ends. This is called 'kaanchtaankna' (stitching the glass). The bangles are further etched upon and polished to be sold in the market.

The gas burner of the furnace.

The craftsman getting glass the furnace on a metallic pipe.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/bangle-making

Metal pipes.

Metal pipes with glass.

Metal pipes with glass.

Metal pipes with glass.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/bangle-making

Metal pipes with glass.

Metal pipes with glass.

Craftsman putting a thin glass wire onto the bangle-coiling rod.

A pointed tool preventing the bangles from sticking with each other.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/bangle-making

The thin glass coiling around the rod and taking the shape of the bangle.

The thin glass coiling around the rod and taking the shape of the bangle.

Heat is constantly supplied so that the bangles don't crack because of sudden cooling.

Heat is constantly supplied so that the bangles don't crack because of sudden cooling.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/bangle-making

Since the rod is filled up, the bangles are being removed.

Since the rod is filled up, the bangles are being removed.

Bangles removed on a metallic pipe.

Another glass stream being cut to be coiled into bangles.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/bangle-making

A craftsman preparing the glass stream to be put on to the bangle rod.

Machine being prepared.

Glass being put on to the bangle rod.

Glass being put on to the bangle rod.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/bangle-making

Glass being put on to the bangle rod.

Bangle coiling begins.

Half way there.

Bangles being prevented from sticking with each other.

Design Resource

Glass Work of Firozabad

The craft of glassware

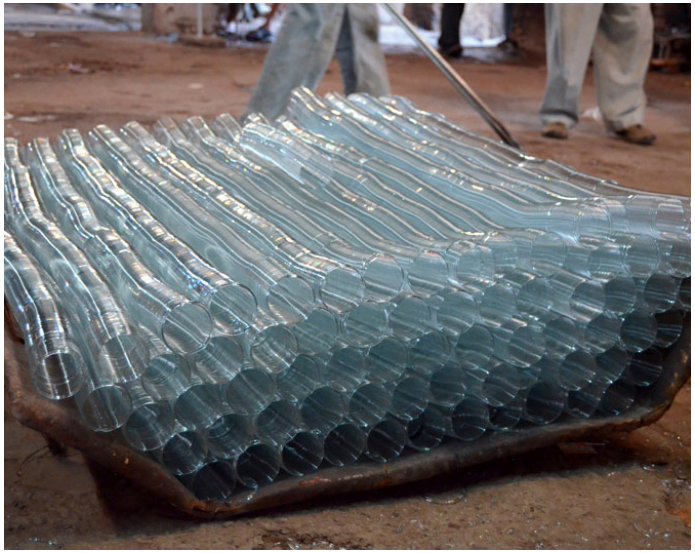
by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/bangle-making

How it looks from the other end.

How it looks from the other end.

Bangles being removed from the rod.



And there are lots of them!

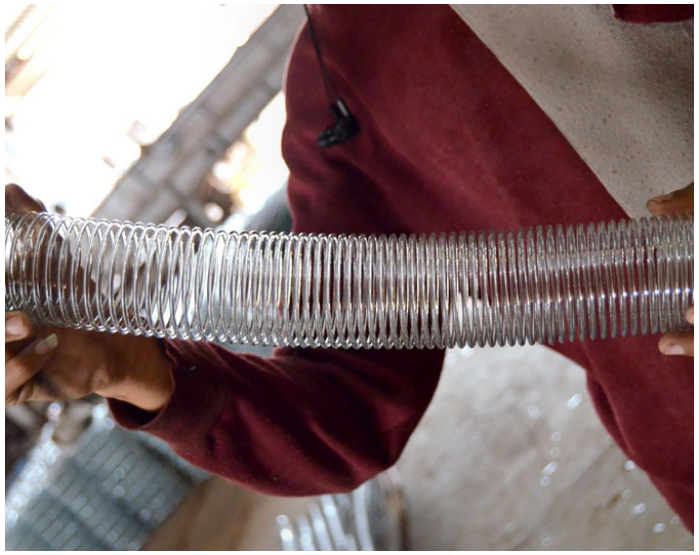
Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/bangle-making



Glass spring generated by coilingthe glass.

Glass spring generated by coilingthe glass.

Glass spring generated by coilingthe glass.

The coil being cut using a diamond cutter, separating the bangles from each other.

Design Resource

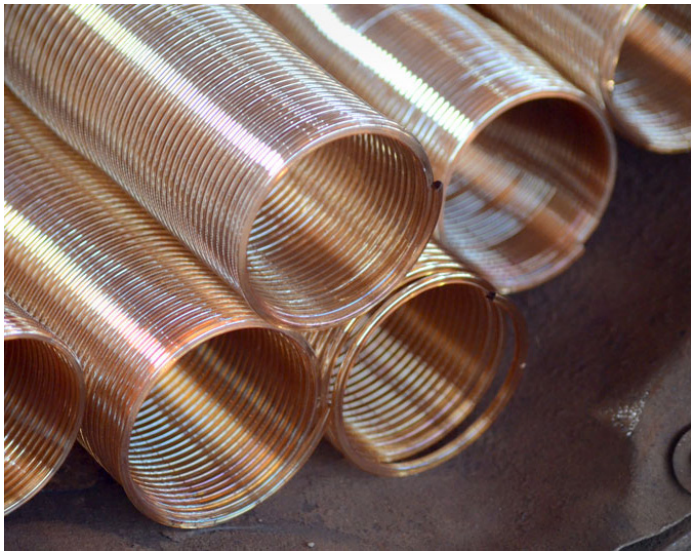
Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/bangle-making

Unfinished bangles.



Unfinished bangles.

Bangles whose open ends are joined, ready to be sold.

Bangles whose open ends are joined, ready to be sold.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-fusing

Glass Fusing

Glass-fusing is another very interesting process to make products that require fine detailing. Pratish kumar has been practicing this for the last twenty years. He works fourteen hours everyday and makes the most astonishing idols for worship - Radha Krishna, Ganesha, Shiva Parvati, Ram Sita etc. His basic raw materials include 'Chinese glass' (borosilicate glass that melts at a higher temperature than ordinary silicate glass), natural gas and oxygen burners, iron tong, carbon base (that doesn't burn with heat) and golden polish (to highlight the features of the figurines). He prefers using Chinese glass tubes because they are absolutely clear and don't crack like the locally available soda glass. This is sourced from the market in Firozabad itself and costs about three hundred rupees a tube. After melting and fusing glass into the product he wants to make, he paint it golden and sends it for another round of firing that makes the gold 'pakka'. One of his kids is learning the craft from him and helps him in packing his products by cotton-wrapping them and putting them in boxes. Customers buy these products from Pratish's home directly.

Gas burners for melting and fusing the glass.

Gas burners for melting and fusing the glass.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-fusing

Borosilicate clear glass

Pratish at work, packaging boxes seen at the back.

Melting the glass with heat.

Melting the glass with heat.

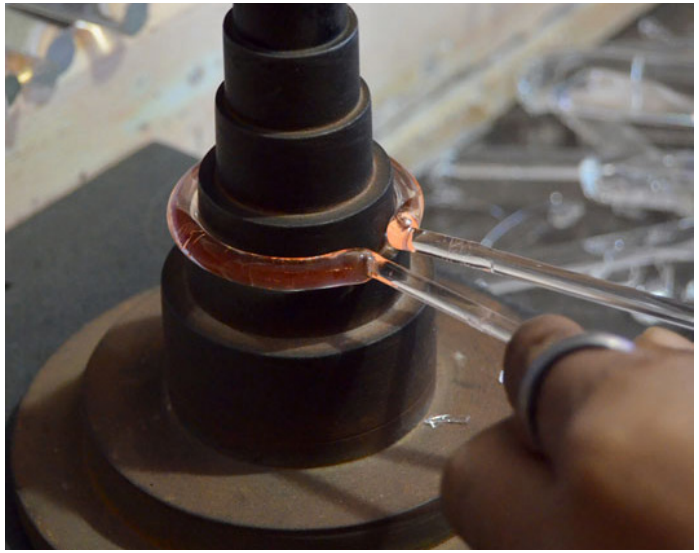
Design Resource

Glass Work of Firozabad

The craft of glassware

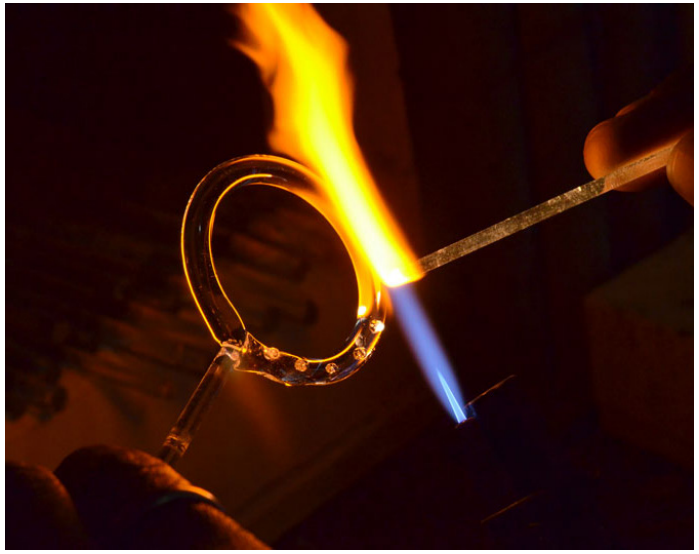
by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-fusing



Bangle measuring rings, seen at the bottom is the carbon base that doesn't burn with heat.

Joining the bangle.



Decorating the bangle with glass drops.

Decorating the bangle with glass drops.

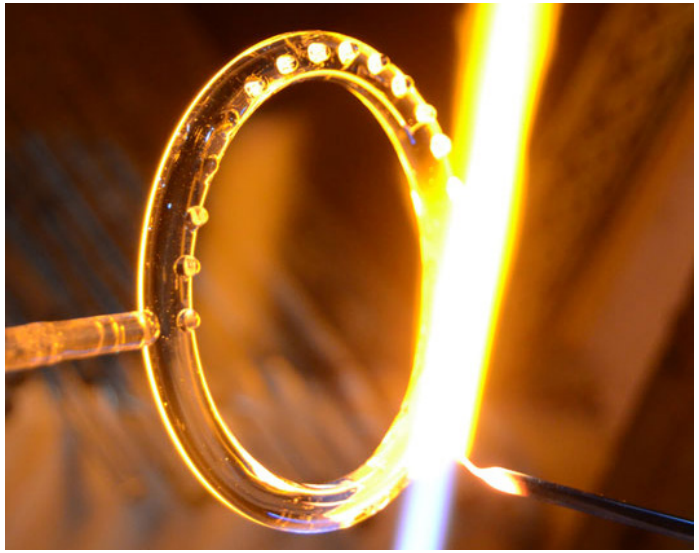
Design Resource

Glass Work of Firozabad

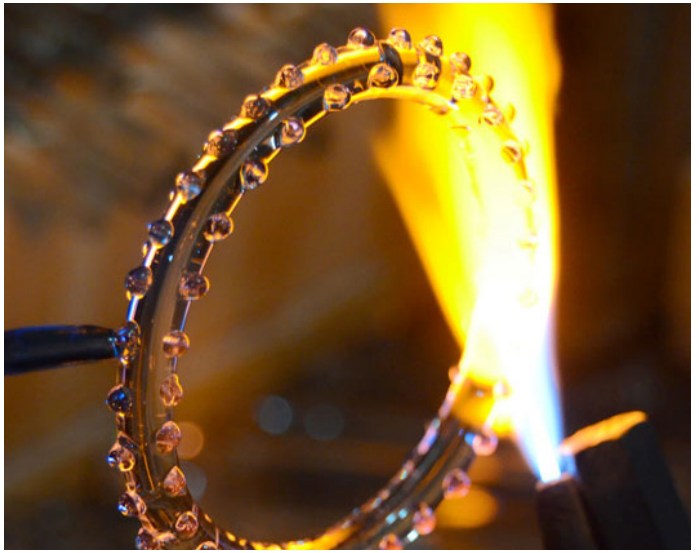
The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

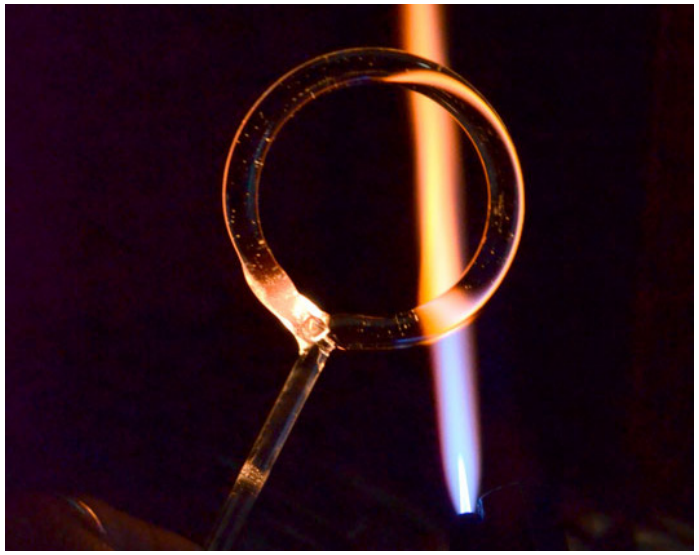
Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-fusing



Decorating the bangle with glass drops.



Decorating the bangle with glass drops.



Decorating the bangle with glass drops.

Decorating the bangle with glass drops.

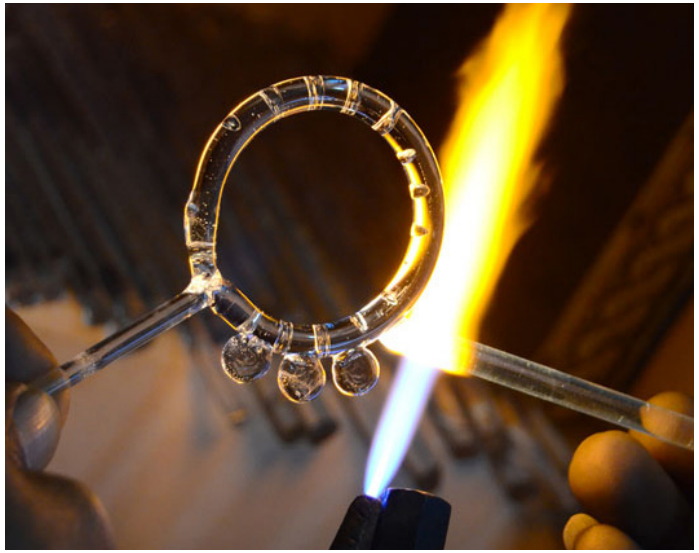
Design Resource

Glass Work of Firozabad

The craft of glassware

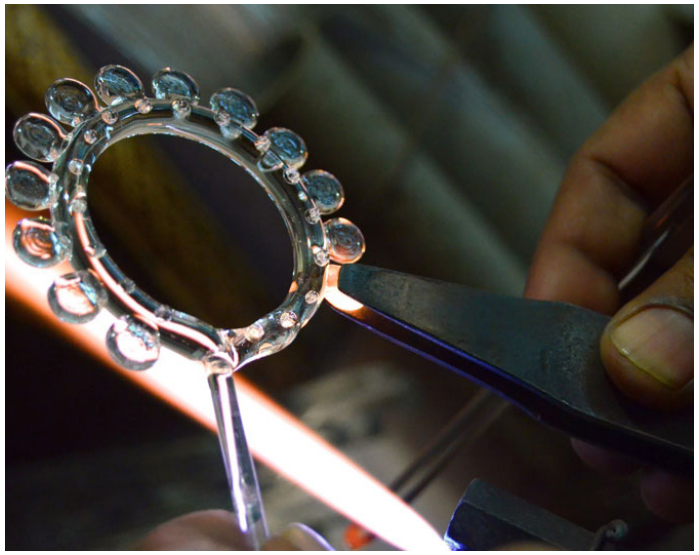
by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-fusing



Decorating the bangle with circles all around.

Decorating the bangle with circles all around.



Flattening the circle with a tong.

Decorating the bangle with circles all around.

Design Resource

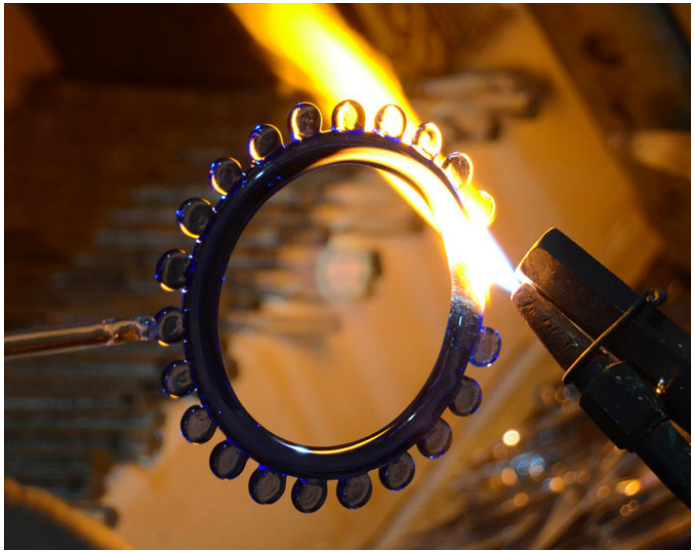
Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-fusing

Decorating the bangle with circles all around.



Decorating the bangle with circles all around.

Melting the glass with heat.

Making feet of the Goddess Laxmi.

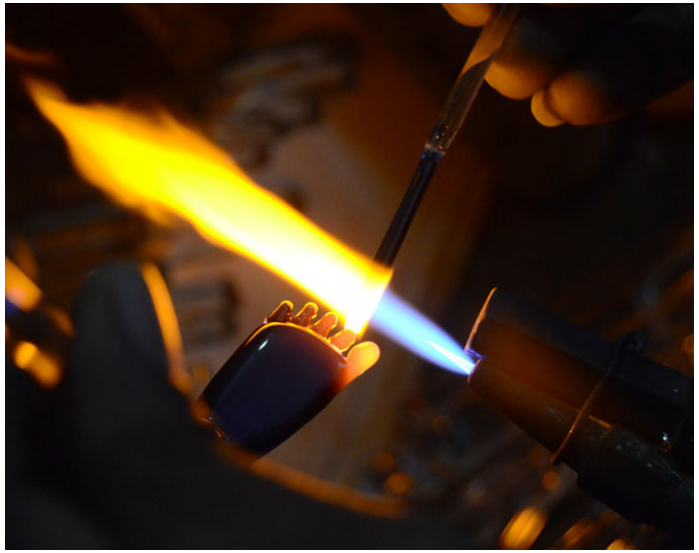
Design Resource

Glass Work of Firozabad

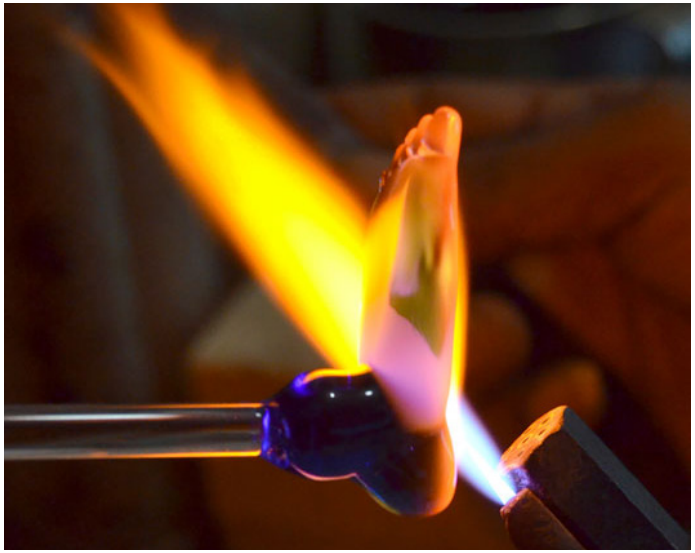
The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/process/glass-fusing



Making feet of the Goddess Laxmi.



Making feet of the Goddess Laxmi.

Making the peacock feather for God Krishna's headgear.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/products

Products

Shops in Firozabad sell a lot of locally produced items as well as a lot of imported glass products from China and Italy. The range includese jars, candle stands, glasses, flower vases, electric wares such as decorative lights, bulbs, Gods and Goddesses, bangles etc. Sometimes, these articles are painted with vivid colors and innovative patterns. Etching is done on some to enhance their beauty.

Beakers.

Dishes.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/products

Lamp shades.

Plates.

bangles

Lord Ganesha.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/products

Lord Ganesha.

Lord Ganesha.

Radha and Krishna.

Lord Krishna.

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/products

Ram, Sita and Laxman.

Lord Shiva.

Ganesha.

Radha and Krishna

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/products

A gorgeous blue bangle.

A gorgeous blue bangle.

bangles

Design Resource

Glass Work of Firozabad

The craft of glassware

by
Sakshi Gambhir
IDC, IIT Bombay

Source:
http://www.dsource.in/resource/glass-work-firozabad/contact-details

Contact Details

This documentation was done by Sakshi Gambhir, M. Des. at IDC, IIT Bombay.

You can get in touch with her at sakshigambhir[at]gmail.com

For Further details you can contact to:

Pratish Kumar
Gopal Das
A-24, Industrial Estate, Firozabad
M: 9837085149

You could write to the following address regarding suggestions and clarifications:

Helpdesk Details:
Co-ordinator
Project e-kalpa
Industrial Design Centre
IIT Bombay,
Powai
Mumbai 400076
India

Phone: 091-22-25767820/ 7801/ 7802
Fax: 091-22-25767803
Email: dsource.in[at]gmail.com