

The history of Glass

Natural Glass

Glass probably exists since the beginnings of time, formed as a result of high-temperature when certain types of rocks melt. Volcanic eruptions, lightning strikes and even the impact of meteorites can trigger this effect. Even on the moon a natural form of glass can be found. One of the samples of moonrock, brought to earth by the crew of the Apollo-14, contains glass.



Cutting tools or spearheads made of obsidian (a natural glass of volcanic origin also known as hyalopsite or Iceland agate) and tektites (naturally-formed glasses of other origin), are believed to be used by Stone-age man.

5000 BC.

The discovery of glass

The ancient-Roman historian Pliny (AD 23-79), describes how Phoenician merchants transporting stone, actually discovered glass accidentally, in the region of Syria around 5000 BC. After landing on a shore, the merchants placed cooking pots on blocks of nitrate placed by their fire. The intense heat of the fire caused the blocks eventually to melt and mix with the sand of the beach and formed an opaque liquid. Glass.

A brief explanation and the origins of glass made by man.

3500 BC.

A new craft is born.

In Egypt and Eastern Mesopotamia, non-transparent glass beads made by man were found, that are thought to date back to around 3500 BC. In central Mesopotamia, around

the third millennium, basic raw materials of glass were being used principally to produce glazes on pots and vases. The discovery may have been coincidental, with calciferous sand finding its way into an overheated kiln and combining with soda to form a coloured glaze on the ceramics. These products and the new art of making glass, was then spread by Phoenician merchants and sailors along the coasts of the Mediterranean.

16th century BC

Early hollow glass production.

The oldest fragments of glass vases (evidence of the origins of the hollow glass industry), however, date back to the 16th century BC and were found in Mesopotamia. Hollow glass production was also evolving around this time in Egypt, and there is evidence of other ancient glassmaking activities emerging independently in Mycenae (Greece), China and North Tyrol.

1500 BC

After 1500 BC, Egyptian craftsmen are known to have begun developing a method for producing glass pots by dipping a core mould of compacted sand into molten glass and then turning the mould so that molten glass adhered to it. While still soft, the glass-covered mould could then be rolled on a slab of stone in order to smooth or decorate it. The earliest examples of Egyptian glassware are three vases bearing the name of the Pharaoh Thoutmosis III (1504-1450 BC), who brought glassmakers to Egypt as prisoners following a successful military campaign in Asia.

9th century BC

Nothing much happens and there is little evidence of further evolution until the 9th century BC, when glassmaking revived in Mesopotamia. Over the following 500 years, glass production centred on Alessandria, from where it is thought to have spread to Italy.

650 BC

Tablets from the library of the Assyrian king Ashurbanipal (669-626 BC) contain the first glassmaking "manual". This manual dates back to around 650 BC. Instructions on how to make glass are engraved on it .

27 BC - AD 14

Starting to blow glass

A major breakthrough in glassmaking was the discovery of glassblowing some time between 27 BC and AD 14. Syrian craftsmen from the Sidon-Babylon area invented a long thin metal tube used in the blowing process, this tube has changed very little since

then. In the last century BC, the ancient Romans then began blowing glass inside moulds, greatly increasing the variety of shapes possible for hollow glass items

The history of mirrors

The history of mirrors dates back to ancient times when mankind first saw reflections in a pond or river and considered it magic. Long before man was able to make mirrors out of glass, mirrors made of metal were used. Sheets of metal, mostly copper, was flattened and polished until it could be used as a mirror. The mirror of the ancient Greeks and Romans was a disk of metal with a highly polished face, sometimes with a design on the back, and usually with a handle. That mirrors were used in ancient times can also be found in the bible:

Exodus 38:8

"And he made the laver of brass, and the foot of it of brass, of the looking glasses of the women assembling, which assembled at the door of the tabernacle of the congregation."

Mirrors in ancient Egypt

These polished bronze mirrors were used to reflect the face. They were made of molten bronze or copper. They were round, oval, square and most of the time they had a handle. If any rust developed it was easily polished new. Later in ancient Rome mirrors were made of tin, silver and even gold. Even in present time mirrors made out of metal are being used. Just think of the laughing mirrors you can find on fairs and carnivals and traffic safety mirrors also small glass mirrors were used. Mirrors made of natural glass 'obsidian' with a surface as shiny as possible. Pieces of this glass sometimes were embedded in walls.

The Romans

Much later, after the discovery of glass making, the Romans made mirrors out of glass by finishing them with a metal layer. At excavations in Germany a mirror made out of glass of 7 x 4 cm, that was covered on one side with a layer of gold that was sealed with a red shellac. In Roman graves dating from the second and third century there were also found pieces of glass covered with lead.

The Middle Ages

Mercury mirrors

After the discovery of glassblowing in the 14th century, mirrors were made out of glass bulbs. The glassblower blew a glass bulb that while still hot, was filled with a mixture of

metals such as lead, antimony and tin, through the blowing pipe. After cooling the bulbs, they were cut in pieces, thus forming little hollow (convex) mirrors. Although these mirrors did not have a perfect reflection, people did not mind at all. The mirrors available at that time were made out of metal which wasn't flat and had an even worse reflection. At the end of the Middle Ages this type of producing mirrors with liquid metals, did evolve into the production of mercury mirrors. The metal used was in fact an amalgam of tin and mercury. A method of backing a plate of flat glass with a thin sheet of reflecting metal came into widespread production in Venice during the 16th century. In 1507 the Danzola del Gallo brothers from Murano near Venice asked the Council of Ten: "...the privilege for 25 years to manufacture clear and almost perfect mirrors out of crystal, unknown to the whole world except to a factory in Germany which in alliance with a Flamish factory held the monopoly in producing this type of mirror glass....".

Therefore we can conclude that in Germany and in Belgium (Flandria) this method was already being used. The exact ingredients and procedure were kept secret for a long time; these mirrors therefore were very expensive. In 1683 the legacy of the French minister Colbert held a Venetian mirror of 115 x 65 cm, mounted in a silver frame. The mirror was sold for almost 3 times the price of a painting of Rubens that was also a part of this legacy!

The reflecting layer of mercury on mirrors, which were made throughout a period of 400 years, existed out of 75% of tin and approximately 25% mercury. The name 'tin mirror' therefore would be more appropriate. Technically spoken, it was neither one of them. The metal used was in fact an amalgam of tin and mercury. Producing this kind of mirrors was complicated and took a lot of time. The process was almost (there isn't an exact description) as follows; On a stone table with a gutter along all 4 sides, a sheet of tin was placed that was slightly larger then the mirror to be made. This sheet was then secured on all sides with aggravated lathing. On the tin sheet a small amount of mercury was poured, that then was rubbed in with a cloth, to ensure a connection was made. In the Middle Ages this rubbing had to be done with a hare leg. After that, a 3 to 6mm thick layer of mercury was poured on the tin sheet. All the clogging then was removed and a plate of glass was placed on the mercury. This had to be done very carefully; the plate had to float on the layer of mercury. The plate of glass then was covered with a blanket and aggravated with weights. By removing the lathing all the redundant mercury could flow off through the gutters. The stone table, with the mirror still on top of it, then was slantingly put for a few days, to let the last drop of redundant mercury flow off. Still slant the plate was placed on a lathing construction to dry for at least 3 weeks. According to the description, the moment the plate of glass was lifted from the table was the most crucial moment. If there was a loud detonation anywhere near, (old literature mentions even the fire of a canon) all the mercury would suddenly flow away, and all the work was in vain. Producing a mirror was a complicated and delicate process. On top of that, the production was very unhealthy, due to the fact that mercury fumes are very toxic. This type of mirrors therefore is no longer made. A passage in a very old book tells us:

"A mirror is dangerous; not only to her that reflects herself, but unfortunately this is also true for him, who makes them. The making of mirrors therefore shall receive all the praise of mankind and the industry." Mercury mirrors were moreover well resistant against all kinds of influences. Very old mirrors of this kind still are surprisingly well preserved. Sometimes a crystallization of amalgam can be found on the lower part of the mirror, that side on which it stood to let the redundant mercury flow off.

19th century

The Silver mirror

The chemical process of coating a glass surface with metallic silver was discovered in the 19th century. This advance inaugurated the modern techniques of mirror making. Until this day, a few country's still have a dispute about who delivered the inventor of this process.

Most German books mention Liebig, English Drayton, the French Petit-Jean and the Italian Choron. The German Justus von Liebig however, would be the most probable. He published an article in 1835 with the scope: "...when aldehyde is mixed with a silver nitrate solution and heated, a reduction is formed, as a result of which the silver settles itself on the wall of the vessel, forming a superb mirror."

This chemical process forms the fundament on which later research has been based. In the course of the years many procedures have been developed and patented.

Modern fabrication of mirrors

Present-day mirrors are made by sputtering a thin layer of molten aluminum or silver onto the back of a plate of glass in a vacuum. In mirrors used in telescopes and other optical instruments, the aluminum is evaporated onto the front surface of the glass rather than on the back, in order to eliminate faint reflections from the glass itself. The production of mirrors takes place in a production line of app. 450m.long.

"Normal" production process

The production process can be split up in to the following steps:

- loading the production unit with a selected high quality transparent or colored float glass
- cleaning with cerium oxide
chalk and water - drying
- silvering with silver nitrate
- coating with copper sulphate to protect the silver
- cleaning, drying and hardening

- first coating - drying
- second layer of paint both layers of paint protect the silver for chemical influences
- cooling and cleaning

"Environmental friendly" production

The course of the process:

- loading
- cleaning and drying
- activation treatment of the glass
- silvering
- pasivation treatment after silvering
- coating preparation
- first layer of paint - drying
- second layer of paint - drying
- cooling and cleaning

Copper sulphate is no longer used as well as leaded paint and even the amount of ammonia salts used is much lower. The result is a mirror that has been produced in a "environmental friendly" way. This type of production has become more common and according to this process, there is made app. 125 million m² of mirror glass worldwide. ...the privilege for 25 years to manufacture clear and almost perfect mirrors out of crystal, unknown to the whole world except to a factory in Germany which in alliance with a Flamish factory held the monopoly in producing this type of mirror glass....".

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THE MIRROR

History

The first mirrors used by man were most likely pools of dark, still water, or water collected in a primitive vessel of some sort. The earliest manufactured mirrors were pieces of polished stone, such as [obsidian](#), a naturally occurring volcanic glass. Examples of obsidian mirrors found in [Anatolia](#) (modern-day Turkey) have been dated to around 6000 BC. Polished stone mirrors from central and South America date from around 2000 BC onwards

Mirrors of polished copper were crafted in [Mesopotamia](#) from 4000 BC,^[1] and in ancient Egypt from around 3000 BC. The use of polished metal mirrors – [copper](#), [tin](#), [bronze](#), [silver](#) and [gold](#), and later [steel](#) and [pewter](#) – continued through the [ancient Greek](#) and [Roman](#) civilizations until the middle ages. In China, bronze mirrors were manufactured from around 2000 BC.

Metal-coated glass mirrors are said to have been invented in [Sidon](#) Lebanon in the first century AD, and glass mirrors backed with [gold leaf](#) are mentioned by Roman natural

philosopher [Pliny](#) in his [Natural History](#), written in about 77 AD. The Romans also developed a technique for creating crude mirrors by coating blown glass with molten lead. Some time during the early [Renaissance](#), European manufacturers perfected a superior method of coating glass with a tin-mercury [amalgam](#). The exact date and location of the discovery is unknown, but in the 16th century, [Venice](#), a city famed for its glass-making expertise, became a centre of mirror production using this new technique. Glass mirrors from this period were extremely expensive luxuries. The [Saint-Gobain](#) factory, founded by royal initiative in France, was an important manufacturer, and [Bohemian](#) and German glass, often rather cheaper, was also important.

The invention of the [silvered-glass](#) mirror is credited to German chemist [Justus von Liebig](#) in 1835. His process involved the deposition of a thin layer of metallic silver onto glass through the chemical reduction of silver nitrate. This led to greater availability of affordable mirrors and ultimately the silvering process used in modern mirror production.

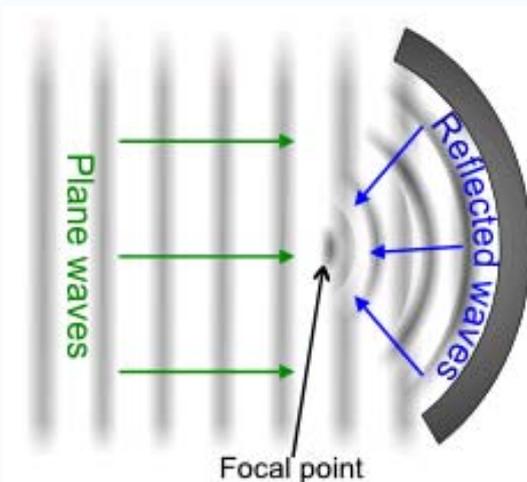
Most mirrors are made by applying a reflective coating to a suitable substrate. The most common such substrate is glass, due to its ease of fabrication, its rigidity, and its ability to take a smooth finish.

Once the substrate is shaped, polished and cleaned, it can be coated. Glass mirrors are most often coated with silver or aluminum, implemented by a series of coatings:

- liquid tin • liquid silver • chemical activator • liquid copper • paint

The tin is applied because the silver will not bond with the glass. The activator causes the tin/silver to harden. Copper is added for long-term durability.^[8]

In some applications, generally those that are cost-sensitive or that require great durability, mirrors are made from a single, bulk material such as polished metal.



Effects

In this diagram plane waves reflect off a parabolic mirror to form waves converging onto a focal point. In a plane mirror, a [parallel](#) beam of [light](#) changes its direction as a whole, while still remaining parallel; the images formed by a plane mirror are [virtual images](#), of the same size as the original object (see [mirror image](#)). There are also [concave mirrors](#), where a parallel beam of light becomes a [convergent](#) beam, whose rays intersect in the [focus](#) of the mirror. Lastly, there are [convex mirrors](#), where a parallel beam becomes divergent, with the [rays](#) appearing to diverge from a common intersection "behind" the mirror. Spherical concave and convex mirrors do not focus parallel rays to a single point due to [spherical aberration](#). However, the ideal of focusing to a point is a commonly-used approximation. [Parabolic reflectors](#) resolve this, allowing incoming parallel rays (for example, light from a distant star) to be focused to a small spot; almost an ideal point. Parabolic reflectors are not suitable for imaging nearby objects because the light rays are not parallel. A beam of light reflects off a mirror at an angle of reflection that is equal to its angle of incidence (if the size of a mirror is much larger than the wavelength of light). That is, if the beam of light is shining on a mirror's surface at a 30° angle from vertical, then it reflects from the point of incidence at a 30° angle from vertical in the opposite direction

Mirrors and superstition

It is a common [superstition](#) that someone who breaks a mirror will receive seven years of bad luck. One of the many reasons for this belief is that the mirror is believed to reflect part of the [soul](#); therefore, breaking the mirror will break part of the soul. However, the soul is said to regenerate every seven years thus coming back unbroken. To counter this one of many rituals has to be performed, the easiest of which is to stop the mirror from reflecting the broken soul by grinding it to dust. Another superstition claims it is bad luck to have two mirrors facing each other.¹ According to legend, [vampires](#) cannot see their reflections in mirrors

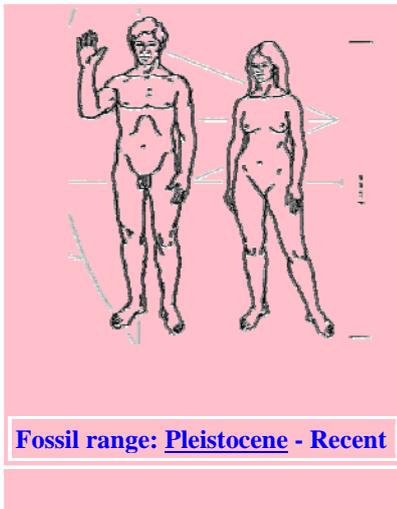
Mirror and Animals

Experiments have shown that only large-brained social animals are able to recognize that a mirror shows a reflection of them.

Animals that have shown they are able to use a [mirror to study themselves](#):

- [Asian elephants](#)
- [Bonobos](#)
- [Common chimpanzees](#)
- [Dolphins](#)
- [Humans](#)
- [Orangutans](#)

Mirrors and Humans



Humans depicted on the Pioneer plaque

Scientific classification

Kingdom: Animalia

Phylum: Chordate

Class: Mammalia

Order: Primates

Family: Hominidae

Genus: Homo

Species: *H. sapiens*

Subspecies: *H. s. sapiens*

Trinomial name

Homo sapiens sapiens

Linnaeus, 1758

Humans, or **human beings**, are bipedal primates belonging to the mammalian species *Homo sapiens* (Latin: "wise man" or "knowing man") in the family Hominidae (the great apes).^{[1][2]} Compared to other living organisms on Earth, humans have a highly developed brain capable of abstract reasoning, language, and introspection. This mental capability, combined with an erect body carriage that frees their upper limbs for manipulating objects, has allowed humans to make far greater use of tools than any other species. DNA evidence indicates that modern humans originated in Africa about 200,000 years ago,^[3] and they now inhabit almost every continent, with a total population of over 6.6 billion as of 2007.^[4]

Like most primates, humans are social by nature, however humans are particularly adept at utilizing systems of communication for self-expression, the exchange of ideas, and organization. Humans create complex social structures composed of cooperating and competing groups, ranging in scale from small families and partnerships to species-wide political, scientific and economic unions. Social interactions between humans have also established an extremely wide variety of traditions, rituals, ethics, values, social norms, and laws which form the basis of human society. Humans also have a marked appreciation for beauty and aesthetics which, combined with the human desire for self-expression, has led to cultural innovations such as art, literature and music.

Humans are also noted for their desire to understand and influence the world around them, seeking to explain and manipulate natural phenomena through science, philosophy, mythology and religion. This natural curiosity has led to the development of advanced tools and skills; humans are the only known species to build fires, cook their food, clothe themselves, and use numerous other technologies.

Druze Beliefs and the Mirror

The material world is a "mirror" or emanation of the Divine Intelligence

Druze religious symbols have **five colors** consisting of Green, Red, Yellow, Blue and White respectively. These colors represent the five wise prophets of Al-Mowahideen.

1. **Green** (Al-Akl) symbolizes "the mind," Christ's Consciousness, the pristine mirror of truth, Plato's sun whose light makes knowledge of the truth possible.

2. **Red** (Al-Nafs) symbolizes "the soul," the moon (the gentle reflector of the sun) the receiver of the light and the witness of the truth in every age.
3. **Yellow** (Al-Kalima) symbolizes "the word", who's the mediator between Plato's realm of eternity and Aristotle's realm of material existence. "The word," after all is the purest form of expression and the softest embodiment of the truth.
4. **Blue** (Al-Sabik) symbolizes the potential, the mental power of the will to become.
5. White (Al-Tali) symbolizes the actualization of the potential, the be-coming of the blue power, the full materialization of Plato's world of forms in the world of matter.

Mirror and Christianity

1- "But we all, with our face having been unveiled having beheld the glory of the Lord as in a mirror, are being changed into the same image from glory, to glory, even as by the Lord spirit (2Co 3:18)"

2- "For if anyone is a bearer of the word and not a doer, he is like a man who looks at his natural face in a mirror, for once he has looked at himself and gave away, he has immediately forgotten what kind of person he was." (The Epistle of James 1:23-24)

3- And he made the laver of brass and the base thereof of brass, of the mirrors of the ministering women that ministered at the door of the tent of meeting (Exodus38:8)

4 - For now we see through a glass, darkly; but then face to face: now I know in part; but then shall I know even as also I am known (CO: 1-13-12 :)

5 - Hast thou with him spread out the sky, which is strong, and as a molten looking glass (JOB-37-18:)

6 - JAM-1-23: For if any be a hearer of the word, and not a doer, he is like unto a man beholding his natural face in a glass (JAM-1-23 :)

Mirror in Freemasonry

After leading the new member from darkness to Light and repeating the Oath, the future apprentice standing between the columns hears the W.M. saying to him:" ... you promised to reconcile with your enemies if you meet some of them here. This is the moment to execute your promise. Look, our enemies are not always in front of us, they watch us often in the darkness. Look back." At that moment the initiate execute the order and is located face to face with his godfather or Master of Ceremony, he does not see the face of the latter who stretches in front of him a mirror, that reflects his own face. The W.M. explains to the apprentice that we wanted to explain to him that our bigger enemy is often in ourselves, so it is necessary for us first to fight our errors, prejudices and passions. We acknowledge that this practice is an option in the jurisdictions. We find the symbol of the mirror in the RER but at the increase of salary to the second degree. The Mirror is a symbol reflecting the external picture of the human being in its

physical and psychological status at a time, which means the EGO of the individual, Mirror symbolizes the towards an Ego non controlled, similar to a non treated rock, poorly elaborated which will not in measure to improve efficiently the society. When this sequence of the events is executed, it remains for a long time engraved in the memory of the Freemason.

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