Le Wistful Jeweller

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Wednesday, 11 September 2013

The twilight turns from amethyst.....

To deep and deeper blue,
The lamp fills with a pale green glow
The trees of the avenue.
The old piano plays an air,

Sedate and slow and gay;
She bends upon the yellow keys,
Her head inclines this way.

Shy thoughts and grave wide eyes and hands
That wander as they list--
The twilight turns to darker blue
With lights of amethyst

THE TWILIGHT TURNS FROM AMETHYST
by: James Joyce (1882-1941)

Almost all gems can be synthesised -
What is a synthetic - A synthetic is a man-made material, which has the same composition and crystal structure as the natural material. The first gemstone to be created in laboratory was Quartz all the way back in 1845 - by German geologist Karl Emil von Schafhäutl. He grew microscopic quartz crystals in a pressure cooker using an early version of the Hydrothermal Method (described below).
Quartz ((SiO2) is a crystalline rock or mineral it is composed of the product of **silicon** and **oxygen – silicon dioxide.** Quartz is the second most common mineral in the Earth's continental crust (natural ice being the most common, see my previous Blog "An Emerald Is As Green As Grass" to read about minerals) and found in all types of geological environments. There are 49 variety's, a number of which are gemstones, e.g. amethyst, citrine, smoky quartz, rock crystal, rose quartz. Origin of name from Saxon word Querkluftertz = cross-vein ore. The colour varies from colourless, white, grey, yellow to brown to black, violet, pink and purple. In spacious cavities quartz crystals can grow large, sometimes weighing several tons. Clear colourless quartz, called rock crystal, is the most common gem mineral. Rock crystal is used for carvings, chandeliers and crystal balls.
Take a look here at a beautifully carved rock crystal ewer from Egypt AD 969-1171

In the Smithsonian Institute is the world's largest, flawless quartz sphere. It is 242,323 carats, weighs 106.75 lbs. (48.5 kg), and measures 12.9 inches (32.7 cm) in diameter. The sphere was cut and polished in China in 1923-1924, though crystal from which it was cut may have come from Burma.

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Example of a Rock Crystal Chandelier

However, the need to synthesise quartz came about not for adornment but for its use in technology.

The discovery of piezoelectricity (from the Greek word meaning “to press”) by the Curie brothers was an important scientific discovery. Pierre and Jacque found that when pressure is applied to certain certain nonconducting crystals, such as quartz, it polarizes them resulting in an electric field which is detectable as a voltage. When subjecting piezoelectric crystals to an externally applied voltage, inverse piezoelectricity, the crystals change shape by a minute amount. When the polarity of the voltage is alternated, the crystal rapidly expand and contract producing a vibration. This deformation, although only nanometres, has important practical applications such as the production and detection of sound.

Paul Langevin, a student of Pierre Curie's, found that inverse piezoelectricity causes piezoelectric quartz in alternating fields to emit high-frequency sound waves. This led to the use quartz in a variety of applications including the first practical transducer (A transducer is an electronic device that converts energy from one form to another) for ultrasonic pulse-echo detection which were used to detect submarines and explore the ocean's floor.

Pierre and Jacque Curie

When a crystal is made to vibrate at its natural frequency by the application of a voltage, the system is said to be in resonance. A crystal in resonance will maintain a constant, unfaltering frequency. When coupled with vacuum tubes or transistors, this constant frequency can be changed into a radio signal so Piezoelectric crystals were also used in radio broadcasting and stereo equipment.

Quartz is also used in timekeeping as an oscillator to keep regular time (an oscillator is an instrument for producing movements of a regular speed - oscillations) In a quartz timepiece, a small ring-shaped piece of crystal is made to vibrate at its natural frequency – resonance. A microchip reads how many times the quartz vibrates each second -an incredible 32,768 times per second!! and uses that information to keep accurate time. Because the crystal's vibration is consistent, quartz clocks are among the most precise timekeeping devices. Quartz crystals can be used to regulate both digital and analog clocks and watches.

Quartz crystals also time and coordinate signals for microprocessors, computers, programmable controllers and other digital equipment.
Read in detail about piezoelectricity here.

About Me

Corinne Olivia

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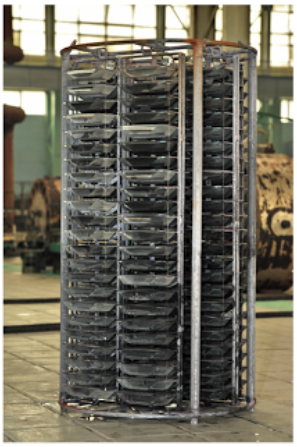
Crushed quartz or silicon crystals (Lasca) are added to the dissolving zone with water and a mineralising agent such as sodium hydrochloride or sodium carbonate, this mixture known as the Nutrient. The Growth Zone has sections of seed crystals, plates of quartz on which the crystal will grow. The shape of these seeds determines the shape of the resulting crystal. The autoclave is heated to 400ºC and this raises the pressure to 21,000 psi causing the crushed quartz to dissolve in the liquid. Due to convection this then rises through the Baffle into the growth zone. The Baffle restricts and shapes the flow of the convection of the nutrient into the Growth Zone.

As the supersaturated solution moves up to cooler growth zone, about 50ºC cooler, it can't hold on to the silica and it is deposited on the plates. As the nutrient cools it flows down and the process continues until there is no longer enough Lasca dissolved to saturate the nutrient mixture.

Crystal up to 50mm x 150mm can be grown in 3 to 4 weeks, sometimes it can take a year to grow larger crystals. These are created by using these first generation pieces as the seed plates in a second or even third run. There are facilities that grow huge crystals up to a metre across and 15 metres high.



The growing chamber for quartz crystal

Of course quartz can also be produced for the Jewellery Industry, again its personal preference whether or not you want natural or synthetic.

Synthetic quartz can be coloured "doped" by adding other minerals; adding Iron will turn the quartz green or yellow to make Citrine, Cobalt will turn it blue (natural blue quartz does not exist) and to make Amethyst iron oxide is added and the crystals exposed to radiation.

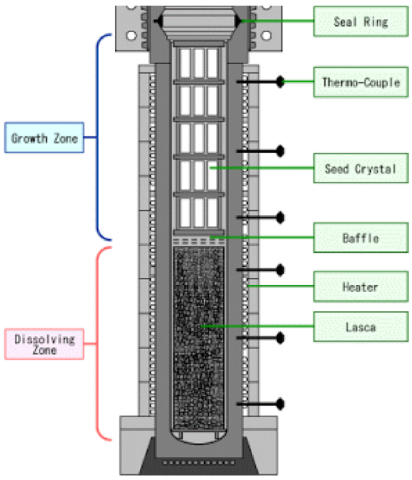


Diagram of an autoclave.

Another type of man-made quartz, fused quartz, is made by melting down pieces of natural quartz and reforming it into almost any shape. Fused quartz doesn't expands or contract with changing temperatures, so is an ideal component of scientific equipment, such as telescope and microscope lenses. It also is an conductor of heat, light, and ultraviolet rays and it can be used to direct light rays through bends and angles. It is nearly impervious to acids and other chemicals so is often used to make test tubes and other chemical containers.

Next time other synthesised gemstones and the methods used.

Posted by Corinne Olivia at Wednesday, September 11, 2013

Labels: amethyst, Curie, James Joyce, quartz, rock crystal

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