GLASS AS A MATERIAL FOR BODY JEWELRY

THE CALIFORNIA LEAD LAW

The new Lead-Containing Jewelry Law was recently passed and regulates the amount of lead permitted in children's jewelry and body piercing jewelry in the state of California. The legislation defines body piercing jewelry as, "Any part of the jewelry that is manufactured or sold for placement in a new piercing or mucous membrane, but does not include any part of that jewelry not placed in a new piercing or mucous membrane." The law regarding body jewelry went into effect March 1st, 2008. The penalty is $2,500 per day per violation.

The law is somewhat ambiguous regarding glass, as glass is not listed as an acceptable material for jewelry in a new piercing or set in a mucous membrane. While this is a concern, the bottom line is that enforcement is aimed at lead-containing jewelry; therefore leaded glass types are the most directly effected by this law. It is probable that the authors of the law were not aware that glass is a common material in body piercing jewelry. Lead is added to glass mainly for it's optical properties; it makes glass denser and increases the refractive index, making it more brilliant. Lead crystal generally has 32% lead content by weight, a large amount by any standard. There is already legislation that restricts the use of lead crystal for use as wine decanters, as the acidic wine causes a release of lead into the liquid. Other glass types may have lead added as an additional ingredient, including colored soda-lime and borosilicate glass types. MSDS sheets should be requested from glass manufacturers to confirm that lead free glass is being used.

Swarovski crystal is a leaded glass used as a decorative element in piercing jewelry. The California Lead-Containing Jewelry Law says this in regards to Swaroski crystal;

"Glass and crystal decorative components used in adult jewelry are considered Class 1 materials. There are no lead limits for Class 1 materials used for adult jewelry. Therefore, the use of leaded crystal, including Swarovski crystal, may be used in adult jewelry. The use of crystal or glass decorative components in children's jewelry is limited to a total of 1 gram. However, the law specifies that glass or crystal decorative components that contain less than 0.02% (200 ppm) lead by weight and have no intentionally added lead are not part of the 1 gram calculation. In other words, the use of Swarovski crystal (or any other crystal 0.02% (200 ppm) or higher in lead) in children's jewelry is limited to 1 gram total. Crystal or glass components containing less than 0.02% (200 ppm) lead by weight with no intentionally added lead may be used in children's jewelry without any weight limitations."

Since the Swaroski crystal is used in gem sets AND weighs less than 1 gram, there is no legal problem using piercing jewelry with Swaroski crystal in gem sets where it does not come into contact with initial piercings or a mucous membrane.

GLASS AS A MATERIAL FOR BODY JEWELRY

COLORANTS IN GLASS

Coloring agents are added to the glass melt in the form of pure oxides and elements. Generally the amount of oxide used to color a glass batch is very small, under one percent of the volume by weight. You can imagine using a drop of food-dye to color a glass of water as an analogy. The same chemicals used to color soda-lime glass are used to color borosilicate glass. The reason there is not as much color availability in borosilicate glass is that some colorants cannot survive the high temperatures needed to heat borosilicate without boiling and pitting. Colorizing agents are modified into a stabilized matrix during the glass melting process. Particular elements can be identified by chemical analysis, but they no longer possess the properties of those elements or raw materials used in the glass production.

Glass colors can react to temperature changes (striking colors) and also to the type of flame chemistry being used to melt the glass (oxidizing or reducing flame environment). Glass chemistry and color can be compared to baking bread, using the same ingredients does not guarantee the same result. The method of mixing, the cycles of heating, and the type of oven are all factors in the finished color. Because of the nature of striking colors and the unpredictability of glass alchemy, consistency in some glass colors is challenging (red in particular). Since glass manufacturers use pre-formed glass in the form of colored rods and sheets to create jewelry, the quality and color of the raw material determines the quality of the finished jewelry.

GLASS AND LEACHING

After discussing glass colorants it is natural to address the concern of glass leaching, or better said the danger of ingredients leaching out of glass. Generally speaking glass is a relatively inert material, but it would be untrue to deny that leaching occurs. In fact leaching is an ordinary event and can be identified as a discoloration or dullness on the surface of the glass.

The Schott Guide to Glass describes the leaching process;
"Leaching causes sodium and potassium ions to be dissolved from the glass structure. The concentration of hydrogen ions (pH value) is changed by the implantation of hydrogenous ions in the glass, water molecules infiltrate the glass while alkali ions go into the solution. A thin gel layer of low alkali and poor water content is formed, about 100 millionths of a millimeter thick. If that layer becomes thicker it becomes visible as dullness. Drinking glasses may show that appearance after several hundred cycles in the dish water."

It is the sodium and potassium that leach out of the glass, in miniscule amounts and after multiple washing cycles over long periods of time. Some very unusual circumstances may accelerate leaching, such as autoclaving glass jewelry hundreds of times, and is not recommended. Stomach acids can cause leaching, glass should never be eaten. Acidic substances such as wine can also accelerate leaching. Under everyday circumstances and during the average lifetime of glass jewelry, leaching is negligible. Glass is widely used in packaging food and beverages, cosmetics and perfumes, and in the pharmaceutical industry because of its chemical stability.

Leaching of metals and oxides are primarily an environmental concern, and pertains to the glass manufacturing and waste disposal. The gradual leaching of harmful elements into the ground water from the leaded glass from old television monitors in land fills is an example. This is a manufacturing and environmental concern and should not be confused by health concerns related to piercing jewelry. Glass leaching and exposure to unhealthy by products of glass is of the biggest concern to the glass artist who is exposed to glass powders and fumes released from the glass in the work environment.

CLEAR CASING

As an extra precaution colored glass can be clear cased, so that the colored glass never comes into contact with the skin. Clear casing glass serves two purposes, first it guarantees that colorants cannot leach out of the surface of the glass, second it prevents thermally sensitive colors (such as cadmium colors) from bubbling and pitting. The textured surface of colored glass that has boiled can leave dangerous sharp edges and leave pockets for bacteria to accumulate, therefore glass surfaces should be smooth without pitting.

Fuming 24k gold and pure silver can also be used to color glass. A small piece of silver or gold is heated on a torch, and as it vaporizes the metal leaves a coating on the surface of the hot glass held in close proximity. This coating needs to be encased with clear glass to protect the coating from being rubbed or scratched off. It is easy to identify fumed metals that have been clear cased. The clear casing creates a lens that adds a magnified effect and greater depth.

GLASS FOR INITIAL PIERCING

While everyone can agree that glass is fine to wear in a healed piercing, there has been a heated debate on the acceptability of glass for use in initial piercings for years. Generally the argument goes that there is not enough scientific data regarding glass as an implant grade material. The limited data that we do have regarding different glass types being implanted shows that the surface of some glass types coming under attack and developing surface texture and even scaling within a matter of weeks. In a study done in the 1970's comparing sixteen glass types implanted in mice, fused quartz performed with the least amount of attack. The majority of glass types currently being used in piercing jewelry have no research whatsoever on glass and bio-compatibility.

The other side of the argument usually goes that many experienced piercers have used glass in initial piercings with a great deal of success for years and that no one has ever developed a glass allergy, so common sense and practical experience prove that glass is an appropriate material. Glass does not become pitted or textured when worn in initial piercings. In reality an implant is a much harsher environment then in a piercing where the wound can breathe and the jewelry can be easily removed if problems develop.

It could also be argued that there are no implant grade standards for gold or niobium, both of which are approved by the APP for initial piercings. The argument that gold has been used for thousands of years in piercing jewelry could be used for glass as well, since glass has an ancient history of use in body jewelry.

Not that glass is completely problem free. A condition identified by piercers as "wet ear" will occasionally occur. It has been theorized that wet ear happens not as a reaction to the glass itself, but paradoxically because of the non-porosity of the glass (normally a great advantage in inserting glass and in wearing comfort). In humid climates and on certain individuals, a slight irritation and sweatiness may occur as the glass does not "breath". Normally the body adjusts and the irritation goes away after a couple of days.

A POSSIBLE ANWSER- BIO-GLASS 8625

Since the late 1960's scientists began experimenting with special glass types to be used in bone reconstruction and dental applications with great success. Certain bio-active glass types actually bond with tissue and bone, and demonstrated anti-microbial and anti-inflammatory properties. Powdered bio-active glasses have actually been formulated into skin creams, make up, and toothpaste for their healing properties.

A cousin to the bone-bonding glass was developed for "fibrous tissue encapsulation", a bio-compatible sheath for transponders implanted in animals. This glass is Schott Bio-glass 8625. Bio-glass 8625 does not bond to soft tissue or bone; it actually has the opposite problem of migrating (anti-migration caps are added in transponders to solve the problem). Bio-glass 8625 has been extensively tested in a series of studies on rats, rabbits, dogs, pigs, and horses since the 1970's. This technology is now used to track tens of thousands of dogs in the USA, to identify herds of cattle, as well as track and identify endangered species. More recently it has been implanted in humans to record individual health information.

Bio-glass 8625 is a soda-lime glass. When implanted Bio-glass 8625 is not inert, it actually forms a calcium capsule around the implant. You can compare the calcium layer around bio-glass to the oxide layer around titanium that gives titanium its bio-compatible characteristics.

"As Thieme et al. (1987) have already measured by means of X-ray emission (PIXE), an ion-exchange reaction occurs in the aqueous environment on the surface of the alkali-containing bioglasses, which proceeds in two phases as claimed by Hench (1974). Phase 1 is dominated by the alkali loss in exchange for hydrogen ions; calcium also diffuses from the material. In phase 2 occurs the hydrolytic cleavage of the Si-O-Si bond with subsequent disintegration of the material. The exchange reactions proceed over about two weeks. Later on is formed a predominantly calcium-containing surface film preventing further leaching of the material."

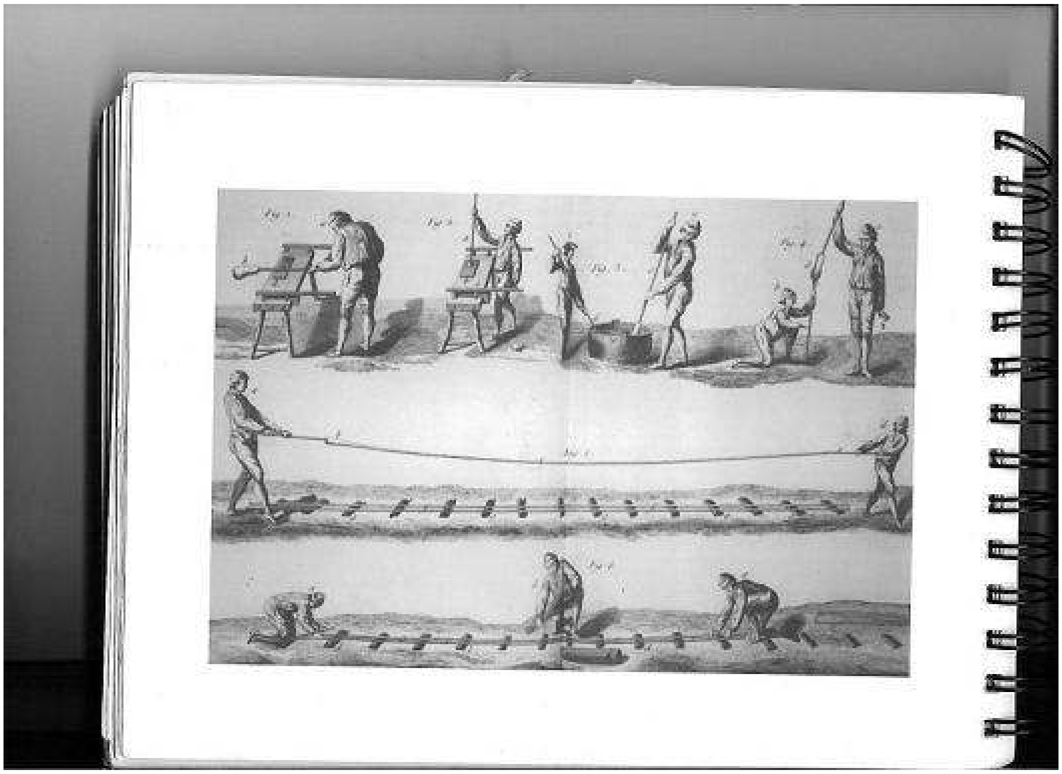
In 1994 the FDA approved Bio-glass 8625 for use in humans. The VeriChip Corporation has been implanting transponders in humans for several years to provide health information on diabetic patients. The electronic chip inside the glass sheath contains the patient's health history and data. Chips are placed in the upper arm or in the hand.

There has been a storm of opposition by Christian groups and other privacy advocacy groups who are worried about the misuse of the technology and the "Mark of the Beast". Last year the Associated Press published an article about cancer tumors forming around transponder chips in mice, implying that they are unsafe. The FDA defended their approval and the VeriChip Corporation issued a twenty page paper detailing (among other things) The Rodent Foreign Body Sarcomagenesis Phenomena, which basically says rats and mice have a unique propensity to develop tumors around implanted devices, regardless of the type of implant. The Associated Press article did not speculate what the cause of the tumors was, but considering that bio-glass has been tested in many studies on different animals and even on humans in bone reconstruction, it seems unlikely that the glass itself is the cause of the tumors in mice.

It has been argued that glass would not meet the requirements of Fitness of Purpose for initial piercings due to breakability issues. I would argue that the damage done by the piercing itself is greater than any danger presented by the jewelry breaking. Furthermore any impact to the ear that would be sufficient to break the glass jewelry would cause much more damage than any potential additional damage caused by the glass breaking.

GLASS AS A MATERIAL FOR BODY JEWELRY

GLASS GAUGES



Gauging glass is problematic. Glass rod and tubing are manufactured in two ways. Understanding the manufacturing process will help you to understand the problem with precise gauging in glass jewelry.

The first method is by hand, executed by a team of expert glass workers. Soda-lime glass and colored borosilicate rod are made by "gathering" glass out of a large furnace of molten glass on the end of a steel rod, much like twisting honey around a spoon. After the gob of glass is large enough (usually requiring three or four consecutive gathers in the furnace), a second artisan attaches another steel rod to the opposite end of the hot glass, which is about the size of a football. Very skillfully the glass workers wait until the glass is at the right viscosity and then walk backwards away from each other, pulling the mass of glass into a long rod (sometimes as long as ten meters). The longer the pull of glass, the thinner the rod. As the glass is stretched out it cools and becomes solid, at which point it can be quickly cut into lengths and put into the annealing oven. This method of pulling hot glass into rods has been in practice for thousands of years, and is the same method being used today.

Hand pulling glass rod presents several challenges for piercing jewelry. If the glass is too hot or less viscous, it sometimes has the tendency to become oval; the glass is still sagging because of gravity as it is being pulled into the rod resulting in the oval shape.

Another challenge is that because the glass is hot and the working time of the glass is short (the time it takes for the glass to cool and become solid) everything has to be done in the moment by eye, with no time for precise measuring. Sorting and measuring the gauges of the glass rods does not happen until the following day when the rod if removed from the annealing ovens. It would not be cost effective for the manufacturer to select only the exact gauge sizes, they would lose the majority of the raw material, and the cost of the finished jewelry would sky rocket as a result. Therefore there is generally a tolerance of one full millimeter in gauging glass jewelry, with stricter tolerances in the smaller gauges. Also slightly oval material is sometimes used. Although it can be frustrating that gauges are not exact, it is also an advantage because in-between and difficult to find sizes are also available.

The second method of producing glass rod and tubing is extruding glass directly out of a furnace. This is used in the mass production of colorless borosilicate rod and tubing for the scientific industry. Massive furnaces gravity feed glass out of an opening at the bottom of the furnace and stretches it onto rollers. The rod is formed directly out of the furnace, without the additional labor and craftsmanship of a team of artisans. Glass rod manufactured in this way has much more consistency in sizing and shape. Rod sizes are usually produced according to the metric system, each size is by millimeter. This creates its own set of challenges, since millimeters do not translate precisely to the gauge system. As a result most glass piercing jewelry companies measure their jewelry in millimeters, which is much more practical for determining sizes and tolerances, and also offer the gauge size as a reference.

It is important to remember that the glass artist making jewelry is limited by the consistency of the glass rod being used. Since glass is a hand crafted product, there will never be the consistency found in steel jewelry.

GLASS AS A MATERIAL FOR BODY JEWELRY

TYPES OF GLASS USED IN PIERCING JEWELRY

In the 1990's borosilicate glass was the only glass type being used for modern piercing jewelry. In the new millennium various other glass types have been introduced as well, including soda-lime, quartz, and barium crystal. Different glass types have different working characteristics; some are better for fusing and kiln forming, while others are easier to work on a torch or blow-pipe. Generally there is a wider color palette in the soda-lime glass types, but the borosilicate color selection has been expanding over the last ten years. Color selection is the main reason for manufacturers to use different glass types. All glass types share certain characteristics that make them a good material for piercing jewelry; non-organic, smooth surface, odorless, autoclavable, light weight, and easy to clean.

Hard and soft glass are not scientific terms and can be confusing. "Hard" and "soft" glass are trade terms originally used by glass workers to describe the viscosity and flow of different glass types. Glass does not have a specific "melting point" or definite temperature where it changes from a solid to a liquid the way metal does. Rather glass has a "softening range" where it gradually begins to become more malleable as it heats up. Soft glass has a relatively low softening point and longer working time. Soda-lime, barium crystal, and lead crystal are all "soft" glass but have very different chemical compositions. Hard glass has a high softening point and a high viscosity with a very short working time. Borosilicate, quartz, and aluminosilicate are "hard" glasses. In order to be more precise specific glass types will be referred to by their chemical composition, and not by their viscosity and workability.

	Coefficient of Expansion	Strain Point °C	Anneal Point °C	Softening Point °C
SODA-LIME	92	472	515	700
BOROSILICATE	33	505	550	780
QUARTZ	5.5	1120	1215	1683
LEAD	89	390	435	630
	Viscosity/ Thermal Properties			

VISCOSITY OF GLASS

The basic glass types used for body jewelry are: soda-lime, borosilicate, fused quartz, barium crystal, lead crystal, and obsidian. Read on for descriptions of these general categories.

SODA-LIME GLASS- the most common glass type, used widely in food and beverage containers, windows, and art glass. It contains three major compounds in varying proportions, but usually silica (about 60-75 percent), soda (12-18 percent), and lime (5-12 percent). Soda-lime glass is available in a wide range of transparent and opaque colors. While soda-lime glass has less resistance to thermal shock than borosilicate glass, it can be annealed without problems.

BOROSILICATE GLASS- any silicate glass having at least 5% boron oxide. Widely used for bake wear and laboratory equipment because of its resistance to thermal shock and good chemical stability. While borosilicate is not physically stronger than soda-lime glass, it has a greater resistance to scratching which helps prevent the formation of crack initiation sites and therefore generally has greater longevity. Borosilicate rod is extruded out of large furnaces, giving superior consistency in sizing.

Pyrex® has been widely used synonymously for borosilicate glass, which can be misleading because the Pyrex® brand name sells both soda-lime and borosilicate glass products. The proper designation should be Pyrex 7740®, which refers to the borosilicate glass. In recent years the quality of Pyrex® has declined and most body jewelry manufacturers use other borosilicate brand name glass types such as Simax® and Schott Duran®.

QUARTZ GLASS- a clear vitreous solid, formed by melting/ purifying quartz sand. This glass can withstand extremely high temperatures. Quartz glass contains 99.98% SiO_2. Although difficult to work this glass because of its high softening point, quartz is one of the chemically purest glass types with good bio-compatibility characteristics.

BARIUM CRYSTAL- a high quality art glass famous for its crystal clear transparency. Similar to soda-lime glass in composition, the addition of barium increases the refractive index in the glass making it more brilliant. Barium crystal is rarely used in manufacturing body jewelry, and there is only a hand full of factories who manufacture this glass world wide.

LEAD CRYSTAL- glass that contains a high percentage of lead oxide (minimum 20% of the batch, generally more than 30%). The lead increases density and the refractive index of the glass. Lead crystal is not acceptable for body jewelry. See more in the discussion of the new California lead law.

OBSIDIAN- a volcanic mineral that was the first form of natural glass used by humans. It is usually black, but can also be very dark red or green. Obsidian has been carved into piercing jewelry by Meso American civilization for millennia. Some body jewelry is being marketed as "obsidian", which is actually man made soda-lime glass. If a glass labeled obsidian is not black or dark red/ green then it probably isn't obsidian.

GLASS AS A MATERIAL FOR BODY JEWELRY

STRENGTH AND BREAKABILITY OF GLASS
In truth glass is a strong material, used in sky scrapers and car windshields. But everyone knows glass can break. Glass is a paradox in many ways. The properties of glass should not be compared to those of metal. For instance, shear strength means a great deal with metals, but has little or no significance in glass. Hardness of glass must be measured in terms that rarely apply to ductile materials. These are some of the mechanical properties of glass and how they are measured.

Strength: The intrinsic or theoretical strength of glasses is considerably higher than is normally measured, but stress concentrations caused by surface imperfections resulting from manufacturing or handling limit the ultimate strength to around 10,000 p.s.i. Laboratory tests have shown glass fibers with tensile strengths of up to one million p.s.i. The practical tensile strength of glass however, is about 5000 p.s.i. Between 70 and 80% of the failures occur in commercial glass near this value. To preserve a safety factor, a prolonged working stress of 1000 p.s.i. is the maximum that should be used. Rate of loading is also important. Glass fatigues under constant load and the faster the loading rate, the higher the apparent strength.
These values can be used for current commercial glasses since the composition of glass has little practical effect on its strength. Most borosilicate glasses, though, tend to resist scratching and therefore usually give better mechanical service.

Ductility: Glass does not plastically deform before failure and therefore breaks in a brittle fashion. In practice, it can be considered to break only from tensile stresses. Failure due to pure shear or compressible stresses is rare. Glass is a nearly perfect elastic material, meaning that it can bend, but will automatically return to its original shape. The strength of glass is measured by various methods.

Young's Modulus (Modulus of Elasticity): Young's Modulus is the ratio between stress and strain, and is determined by measuring the sonic or ultrasonic frequencies of a simple beam at room temperature. Most commercial glasses have values between 9 and 10 million p.s.i. By comparison, steel is 30 million, copper 17 and aluminum 10.

Poisson's Ratio: The longitudinal stretching of any elastic material is accompanied by a lateral contraction, and the ratio of the contraction to the proportional stretching is known as Poisson's Ratio. It is measured by a similar method of that used to measure Young's Modulus. A Poisson's Ratio of 0.20 is usually given for glass since the actual value is very seldom less than 0.18 or greater than 0.22.

Hardness and Impact Abrasion Resistance: Glass hardness cannot be measured by the methods and scales (Brinnel or Rockwell) used for metals. One of the three other scales is usually used.

MOHS: Scratch hardness. Glasses lie between apatite (5) and quartz (7). On this scale glasses are softer than (i.e., can be scratched by) sand, hard steel, agate, emery; and are harder than mica, aluminum and copper.

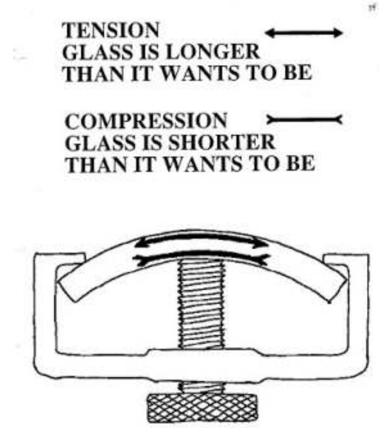
Knoop (and Vickers): Penetration hardness. Typical values for commercial glasses range from 300-366Kg/mm (Knoop Scale) when a load of 50 grams is used.

ZEISS: Grinding or impact abrasion. Impact abrasion resistance is evaluated by measuring the glass resistance to sandblasting under standard conditions. All values are relative. Unity is assigned to soda lime plate (standard window glass) and all other values are assigned relative to this standard.

Density: Density is defined as the mass per unit volume. For glass, density depends upon its composition (primarily) and its thermal treatment (density for a particular glass composition will be greatest when the glass gas has been stabilized at the lowest practical temperatures). It is measured by one of several buoyancy methods, usually a hydrostatic weighing procedure.

	Density	Youngs Modulus (10*8 PSI)	Poisson's Ratio	Impact Abrasion Resistance
SODA-LIME	2.47	10	0.24	1.2
BOROSILICATE	2.23	9.1	0.21	3 to 4
QUARTZ	2.2	10.5	0.17	
LEAD	3.04	8.6	0.22	.6 to .8

Mechanical Properties



FLAWS AND BREAKABILITY

Glass breaks the way it does due to its lack of ductility, and also because flaws concentrate stress increasing its breakability. Flawed glass under tension will fracture, but glass will not fail without both factors (flaw + tension = fracture). Glass breaks only under tension, very rarely from compressive or shear forces.

The reason glass breaks more easily when dropped on a porcelain floor rather than a wooden one is because the hard porcelain will scratch or ding the surface of the glass, while the softer wood will not. It is the resulting damage to the surface of the glass that creates the crack initiation site. It is advised to remove glass jewelry before showering or bathing because the glass may not survive a drop on a porcelain surface.

Advise customers to take care of their glass jewelry. Glass jewelry is often most vulnerable when it is not being worn, and should be stored in a safe, dry place.

GLASS AS A MATERIAL FOR BODY JEWELRY

DEFECTS IN GLASS

DEVITRIFICATION is the process whereby glass becomes partly crystallized as it cools (usually too slowly) from the molten state, and shows as texture or wrinkles on the surface of the glass. Devitrification may also occur on the surface as the result of unsuccessful annealing or accidental heating to a high temperature.

AIR BUBBLES- bubbles of air can be entrapped in the glass during manufacturing. Sometimes an air bubble will be stretched, appearing as a thread through the middle of the glass. This is sometimes confused as a fracture, when it is actually just an air bubble.

SEEDS- an extremely small gaseous inclusion of glass.

STONES- usually pieces of thermal insulating ceramic material from the glass furnace that have accidentally been mixed into the glass.

SCUFFS- broad abrasions on the glass surface.

SCRATCHES- act as crack initiation sites and greatly reduce the strength of the glass.

THERMAL STRESS- the flaw most difficult to detect in glass because it is invisible. Thermal stress is caused by uneven cooling in a piece of hot glass. Glass actually expands microscopically when it softens, and shrinks as it cools. If the glass surface cools faster than the core, than thermal stress will develop within the object as the glass on the surface is shrinking more rapidly, putting it into tension. Glass needs to be annealed in special ovens to equalize the temperatures within the glass as it cools. The rate of expansion and contraction in glass is called the Coefficient of Expansion (COE). Glasses with different COE cannot be combined in the same piece or cracking will occur. One advantage with body jewelry is that the pieces are relatively small, therefore there is less problems with temperature differentials within the glass. The larger or more complicated the piece, the greater the chance for thermal stress to develop. Although thermal stress is normally invisible to the human eye, stresses can be seen in transparent glass using a special lens called a polarioscope.

THE MYTH OF FLAWLESS GLASS

While the goal for any glass company is to produce flawless jewelry, the reality is very different. Due to the nature of glass manufacture, there is almost always an air-bubble, a scratch, or a seed hidden somewhere within the jewelry. It would not be cost-effective (or necessary) to discard all jewelry with a minor flaw. Easily eighty percent of the glass would be rejected and the cost of glass jewelry would be greatly inflated (imagine paying $120.00 for a flawless pair of glass spirals instead of $14.00 for a pair with a small air-bubble). Moreover glass accumulates flaws during its lifespan in the course of wear and handling. By careful storage and handling, the accumulation of new flaws can be greatly reduced.

Quality glass jewelry manufacturers examine the finished products to see what kinds of flaws are in the jewelry, where they are located, and analyze what kind of risk they present to the integrity of the piece. Generally a minor air-bubble or seed imbedded in the body of the jewelry can be ignored if it is not an aesthetic concern. A deep scratch or sharp edge caused by a seed on the surface of the glass would be immediately rejected. Some guidelines to what is unacceptable in glass jewelry are:

NO BURS OR SHARP EDGES
NO DEVITRIFICATION
NO POLISHING COMPOUNDS
NO FRAX RESIDUE FROM ANNHEALING OVENS
NO COATINGS THAT CAN BE SCRATCHED OR WIPED OFF
NO SCRATCHES OR NICKS
NO LEADED GLASS
GLASS JEWELRY MUST BE PROPERLY ANNHEALED