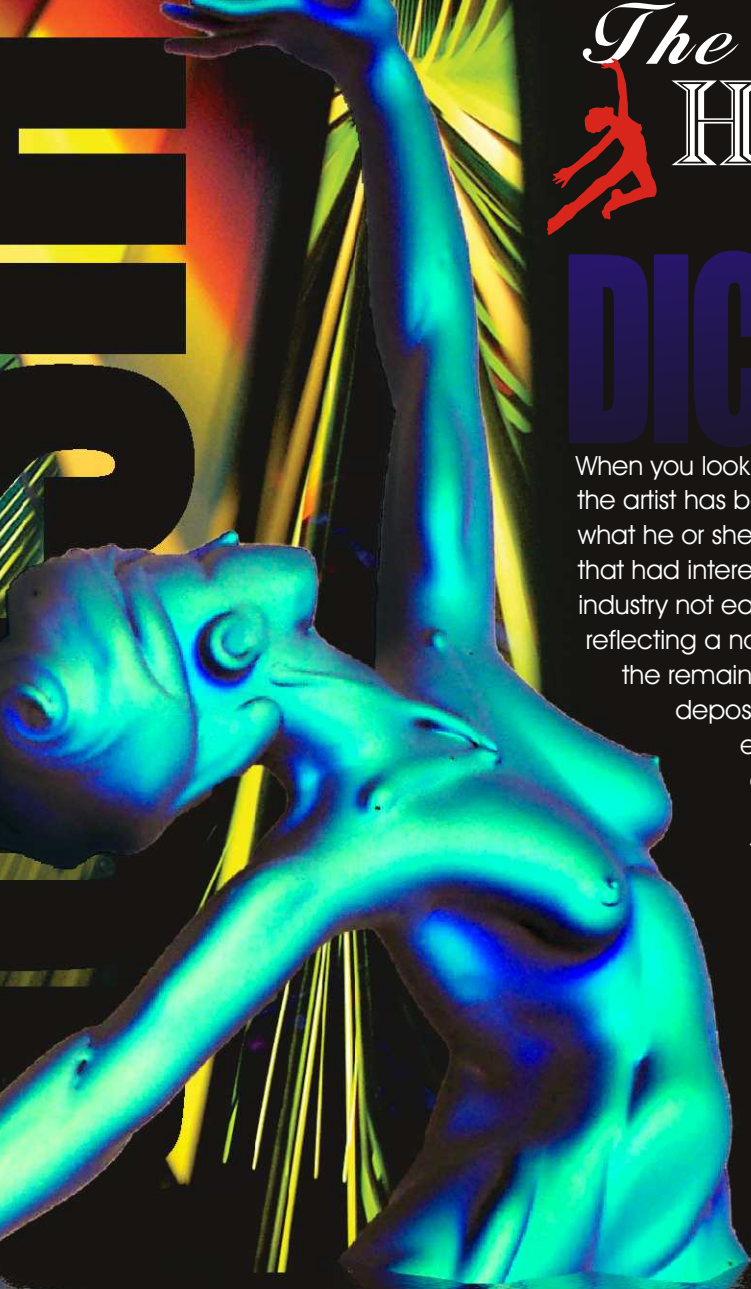


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The HISTORY of

DICHROIC GLASS

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When you look at the history of an artist using Dichroic coated glass, it appears that the artist has been under the major handicap of not having any information on what he or she was working with. These artists were exposed to a piece of glass that had interesting color effects, but came from a very complex and scientific industry not easily understood. These "high-tech" coatings were capable of reflecting a narrow band of light (or one color) and at the same time, transmitting the remaining part of light. The coating process is completed in a vacuum

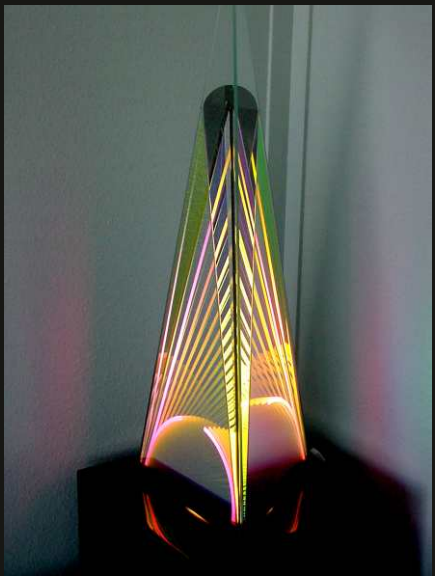
deposition chamber by vaporizing quartz and metal oxides with an electron beam gun and condensing micro thin layers on the surface of the glass in the form of a crystal structure. This coating that we commonly call Dichroic glass today, is actually an "interference filter" permanently adhered to the surface of a piece of glass. The technology used to manufacture the optical interference filter has been in existence for many years. It is known as "vacuum thin film deposition." The roots of this technology date back to the late 1880's. The possibility of depositing thin metal films in a vacuum was discovered in 1887 by Nahrwold and a year later adapted by Kundt for the purpose of measuring refractive indices of metal films. The significant commercial development of thin film deposition however, waited to be spurred by our military and aerospace requirements in the 1950's and 1960's. In the last 30 years this technology has played a key role in optical coating for a vast variety of optical instruments, lasers and laser systems, fiber communication links, optical recording/storage heads and

media, display systems, infrared guidance and detection devices, photoelectric converters, architectural glass, eyeglasses, and many others. The first interference filters used for art were Helium Neon Laser and Hot/Cold Mirrors. The noticeable brightness of light energy from the colorful coatings offered no absorption, unlike normal "Stained Glass" that derives its color by transmitting one band of light and absorbing the remaining part of light. It was 30 years ago when Jerry Sandberg of Coatings By Sandberg, Inc. pioneered his first vacuum, vapor deposited, thin film coatings strictly for art applications. Now, when the word Dichroic Glass is mentioned, the name "Sandberg" quickly comes to mind. The Sandberg Family is the backbone of this high tech aerospace application reinvented for the art glass industry.

It was this pure energy of light that



Glass buttons tooled and coated in the chamber



Example of one of the first uses of Dichroic glass in the art glass industry

attracted the first sculptural glass artists to the thin film mirrors during the mid 70's. A renowned artist by the name of Ray Howlett was the first known artist to develop sculptural Dichroic Glass art pieces by constructing magnificent light boxes that bounced light and color to infinity producing spectacular results. Murray Schwartz was another local sculptural artist and engineer that used rejected aerospace mirrors to create sun catchers and artistic mobiles. Murray's keen sense of resourcefulness led him to dig in the dumpsters in the back of these vacuum deposition facilities to recover the colorful and vibrant mirrors. Jerry Sandberg happened to take notice of Murray digging in the trash for these out of spec mirrors and confronted Murray (This was while Jerry was working for GM Vacuum Coating Laboratory in Newport Beach, California). This was the first interaction that Jerry had with the artist community and was immediately fascinated with the artistic potential of the glass. Jerry then worked with Murray to create the first three Dichroic Glass Colors specifically designed for the art glass industry (Cyan/Red, Magenta/Green and Yellow/Blue). The coatings were costly to produce due to the highly scientific nature and complexity of the operation. These coatings were still designed as highly reflective mirrors, but they were created purely for their color and vibrancy rather than their scientific qualities as in aerospace, optics or lasers.

The next phase in the history of Dichroic glass was an event that would direct Dichroic Glass into the history books. It was Murray's wife Rupama, a fusing artist, that just by chance, put a small scrap piece of a laser mirror into her kiln and melted the glass for the first time. The coatings densified under heat producing a crystalline affect on the surface that shimmered like nothing before and the colors shifted with angle of view and play of light.

It wasn't long before Jerry also started experimenting with the coatings in the kiln. A third generation jeweler as well as an esteemed engineer, Jerry used his knowledge to create some of the first fused Dichroic Glass jewelry. His experiences using the Dichroic glass allowed him to see first hand, what other artists were now experiencing for the first time.

In the early 80's out of high school, I too started playing with the glass. I created sun catchers and then moved on to fusing picture frames for family and friends. Exposure to my father's highly addictive dichroic coatings came early for me as I found a fascination in its power and integrity.

For the next fifteen years Jerry continued to supply the art glass market and continually expanded the pallet of colors at the request of his ever growing harem of artists. A few other coating houses soon started to offer similar vacuum deposited coatings due to the buzz that Jerry had created and nurtured for many years. For Jerry, customer service and a quality product were paramount. The first distributors started selling Dichroic Glass during the 80's as it became more and more popular.



Howard and Jerry Sandberg examining a new installation in the early 80's

By the mid 90's Jerry was being pushed by hundreds of artists to reliably supply their thriving art glass businesses with quality Dichroic Glass Coatings. Jerry's wife Nona (my mother) also came to work to help with the growth of the business. Nona was instrumental at keeping Jerry focused on designing coatings and building & maintaining vacuum equipment. Nona & Jerry found it difficult to be in control of the art glass side of the business while running high tech coatings simultaneously. Jerry offered to purchase GM Vacuum Coating and was declined.

In 1996 Nona & Jerry formed Coatings By Sandberg, Inc. Their mission was to supply the art glass market with reliable, consistent, uniform and durable Dichroic Glass coatings at a reasonable price. Customer service

as well as customer support were key and still is to this day. Before Nona & Jerry were able to finish building their own custom vacuum deposition chamber with a price tag of one million dollars, the two had thousands of dollars in artist orders waiting to be produced. The first CBS Dichroic glass was created in November of 1996. CBS had to sell directly to the end user as distributors were not familiar with the company and unwilling to carry its product. Within the year some distributors were already requesting to open an account with CBS due to the multitude of artists requesting it by name.

Due to the popularity of Dichroic Glass used in art, other manufacturers began making a presence. Some other coater's came and went due to the highly technical aspects, extensive maintenance involved and the cost of the machines. It takes a scientist and an engineer to keep a chamber in top form.

By the late 90's Nona & Jerry had to make a huge decision. Their goal for the company was merely to provide a steady income through their retirement years, yet the market once again, was growing out of control. At that time I was a college graduate running a hospital in Los Angeles as Chief Financial Officer. Nona & Jerry approached me to see if I would be interested in working with them so the business could be expanded by building another chamber to meet the demands of the artist. I jumped at the opportunity and we immediately got started at the CBS expansion.

Not only did we expand production, we also expanded product line. I took to the art glass like I had in my high school days. But now, not only could I enjoy hotworking our product, I too could also help develop new coatings and patterns with the help of Jerry and the CBS staff. I invited well known artists to come teach us at our plant about fusing, slumping and manipulating glass. This all helped keep us in track with what our clients were doing and allowed us to offer extensive technical support to our valuable customers. Sticking to my fathers core values, I turned to our faithful artists to guide us in the creation of new product "artistically" created just for them. We coined our slogan "The Art of Dichroic Glass" since our products are specifically made with the artist in mind. In fact, the Sandberg's specifically designed their chambers for the optimization of art glass as well.



NONA JERRY - CHMBR 1 FINAL - Nona and Jerry in 1996 in front of their first Dichroic Coating Chamber.



TOWNSEND MALE 2 IN 1 - Before and after shot of Milon Townsend Male



By the new millennium CBS had single handedly created the standard in Dichroic Glass Coatings. Our colors were understandable. The color shifts during hotworking was predictable. The coatings were stable and most of all CBS was reliable. All the top distributors were on board with CBS and carrying inventory. As the leading manufacturer of Dichroic Glass CBS has a commitment to the well being of the struggling artist, on up to the world renown master, in the supply of quality Dichroic coatings.

In recent history we have created many more patterns, specialty rainbows, stripes and images. We have coated a multitude of glass including: architectural glass, stained glass, blown glass, fused glass, castings, bevels, rods, stringers, tubing, gems, jewels, cabochons, buttons, ear plugs, ceramics, glass block, tile, and more. We have coated pre-made items such as sculptures from Milon Townsend, hand blown bowls by James Nowak, beads from Sharon Peters and even Swarovski and Waterford crystal.

More family members have joined the CBS team. Most importantly, my wife Tammy has joined CBS and helps me keep on track just as Nona had done for Jerry 20 years earlier. My sister Dana is now on board at CBS also, and handles much of the advertising and website along with the organization of our new teaching program.

Dichroic Glass Coatings have come a long way in 30 years but have many more years in store. Thanks to so much excitement in the art market, Dichroic glass is now used for construction in the form of tile, decorative skylights, mood lighting, lighting fixtures, mosaics, sconces and sculpture. We realize that the future of

Dichroic glass is very dependent on CBS and its practices. We are constantly in a state of analysis, research and development. We have hired "in-house" artists to help test and provide vital input to future product. We have expanded our sample department in an effort to offer smaller amounts at lower price points. In the future, CBS will be experimenting with surface texture, shadowing techniques, new deposition materials, unique patterns and more. Tammy & I and the entire staff at CBS look forward to many more years of new and exiting things to come out of our family business.