Irradiation 101

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This article is an overview of a lecture that I presented at the 2000 Early American Pattern Glass Society convention, along with the results of ongoing tests by myself and glass artist Art Reed. In 2000 we were aware of the practice of subjecting colorless pressed glass to radiation with the intent to alter the glass to a desirable and more valuable color; the dilemma we faced was how to detect this unscrupulous practice.

The history of irradiating glass goes back to at least the mid 1970s. At that time the process was used, primarily by the glass industry of the Czech Republic, as a cheaper method of producing color, albeit in a very limited range. The first dramatic impact on the antiques world occurred in the late 1980s/early 1990s when examples of Lalique glass in a previously unrecorded deep purple began to appear. Single pieces sold at auction for as much as $50,000 before suspicions began to arise which ultimately resulted in fraud charges being leveled against a London dealer. Now all pieces of deep purple Lalique are considered extremely suspect, including all of the previously published examples. In the mid 1990s news of fruit jars and insulators surfacing in radiation-induced colors caused extreme concern in both collecting fields.

Irradiation can be accomplished at any facility with gamma ray or electron beam capabilities. This includes commercial sterilization plants that serve the health care and food industries, along with research facilities, many of which are affiliated with colleges and universities. Both methods disrupt the atomic structure of the glass which affects the atoms' ability to transmit light, ultimately changing the color of the glass. At the present time, the composition of the glass (basically the decolorization agent) appears to be the primary factor as to the resulting color. In testing both colorless lead and soda-lime formulas, the only colors achieved were in the purple and brown spectrums.

Keeping in mind that we are only dealing with American pressed glass produced between approximately 1830 and 1920, we will evaluate the resulting colors. The irradiated browns range from a light smokey topaz to a darker brown, but not a true amber. Dr. Robert Brill of the Corning Museum of Glass suggests that these browns are the result of either cerium oxide or selenium being used as the decolorization agent. Obviously these are not colors used in the medium or period that we are concerned with here; they do however cause concern in the fruit jar and insulator fields.

The irradiated purples, which range from a lavender to a deep purple, occur due to 19th century glassmakers' use of manganese in small amounts to decolor the batch. The same glass manufacturers also added manganese in larger amounts to obtain a purple color (a distinctly different color than the amethyst of the same period which has a reddish shade). Unfortunately, the antique purple and the "new" purple are nearly indistinguishable. In the limited number of examples that I have compared, the irradiated purple has a slightly bluer tone than the old purple. The similarity of these two colors is quite troubling, especially to collectors of lead based wares of the 1830s to 1860s.

Facts relating to the detection and reversal of the results of irradiation have been cloudy at best, with rumors being most often encountered. We have found no simple test to identify an irradiated piece of glass. A Geiger counter is of no use because the glass retains no radioactivity. Similarly, neither short-wave nor long-wave UV (black) light has provided any assistance. To date, the only proven test known to us is actual reversal.

Art Reed has been successful in converting irradiated glass back to colorless, albeit in limited but ongoing tests. He has accomplished this by slowly reheating the glass in an annealing oven, which causes the manganese atoms to revert to their original structure, thereby returning the glass to its colorless state. One of the dangers of this procedure is that different periods of glass appear to have differing temperature points of reversion and melt down. The lead-based examples that we have tested reverted at between 600 and 700 degrees Fahrenheit while the soda-lime example, which was actually the product of natural solarization (sun-purpled), had to be heated to a dangerously high 1050 degrees. We have not yet obtained an irradiated example of soda-lime glass for testing, but hope to in the near future.

Art is currently performing "slump tests" on glass of differing periods in hopes of compiling a maximum temperature scale which will minimize the chance of the test object softening or melting completely. We would like to strongly caution novices against using this reversal process because of the high risk to the glass itself. If an article of glass is heated or cooled too quickly, it will crack or explode from thermal shock. Furthermore, if a piece is overheated it will, and I quote Art, "slump into a puddle."

Our research up to this point has been very encouraging. While purple-irradiated lead formula glass presents a tricky obstacle for collectors and dealers, thankfully there is a foolproof test that can be used to prove or disprove the authenticity of the color. On the other hand, testing and reverting soda-lime formula glass that has been sun-purpled or irradiated appears to be more problematic due to the apparent need for much higher temperatures. A great deal more testing is needed in order to determine the feasibility of using this process safely on pressed glass of this later period.