

## LONG-TERM STABILITY OF UV BLOCKING ACRYLIC

*Does UV blocking acrylic glazing (Plexiglas, Acrylite) lose its effectiveness over time?*

Framed works of art should be protected from ultraviolet light. Though undetectable to the eye, its high energy is more damaging than visible light, exposing materials to the risk of fading, yellowing, structural weakening, and other forms of deterioration. One effective way to protect artwork from UV light is by glazing the frame with UV blocking glass or acrylic.

But does this UV shielding property diminish after prolonged exposure to light? This is an urgent question for all of us who share responsibility for the care of collections. Some have cautioned that the glazing should be replaced every ten years, which would be prudent perhaps, but expensive, and in our experience almost never put into practice. Until quite recently no credible real-time testing of the material had been carried out.

In 2001 Evonik (formerly known as CYRO and the manufacturer of Acrylite brand of acrylic) performed accelerated aging tests on one of their UV blocking acrylic sheets, OP2. The material was subject to focused sunlight under high temperatures and humidity. They found that the light transmitting property of the acrylic was unchanged under conditions that simulated fifteen years of natural aging. But accelerated aging tests are not always reliable and have often been called into question. In fact, there is no substitute for real-time testing.

“Standard” Acrylic glazing without UV blocking additives absorbs 68% of UV energy (of wavelength 200-380nm). A work of art glazed with this material is therefore protected against a significant portion of the damaging UV radiation, and will suffer less from this source than works that have no glazing at all. But the aim of a UV blocking acrylic is to block all the UV energy. To accomplish this, UV absorbers are added to the liquid acrylic before it is extruded or cast.

Some of the energy absorbed by a UV blocking sheet of acrylic will cause the UV absorber to break down into products that will no longer absorb UV light, and this might be a cause for concern in regard to long term effective UV blocking. But there are millions of molecules of the absorber per square inch of surface, and as one researcher has written, “the rate of UV absorber loss is of relatively minor consequence.” The observation is reassuring, but given the importance of blocking UV radiation from works of art, we sought stronger evidence that this property doesn’t significantly degrade.

Since no real-time studies of the UV blocking stability of aged sheets of acrylic had been published, we set out to perform one. So far we have collected and tested eleven sheets of UF3 (manufactured by formerly Rohm and Haas, now Atoglas), which were installed in frames made by Bark Frameworks in the 1980’s; they have been exposed for over twenty five years on average. Vincent Ustach, our materials engineer, designed and built a spectrophotometer utilizing ten LEDs with emissions in the UV range, from 325nm to 395nm. An ELSEC UV monitor from Art Preservation Services was our sensing device.

These eleven sheets of UF3, exposed to light for, on average, twenty seven years, have all retained their UV blocking properties and would be safe to use today. Even the sheet that scored lowest in our test blocked almost 99% of UV energy by our measurements. The mean percentage of UV energy blocked by the ten UF3 samples was 99.32%, ranging from 99.40% to 98.81%.

Sample	Year	% of UV energy blocked
A	1980	99.25%
B	1983	99.36%
C	1983	99.45%
D	1981	99.40%
E	1985	99.32%
F	1982	99.23%
G	1982	99.41%
H	1986	99.39%
I	1984-86	99.27%
J	1984-86	99.16%
K	1988	98.81%
Average		99.32%

Table 1. Samples of 1/8" UF3 with year of first exposure and percentage of UV energy blocked in our tests. Average age of the acrylic was 27 years; the oldest was thirty one years old and the newest was twenty three years.

Since we did not measure the UV blocking property of these sheets at the time we made the frames we have no "before and after" data, but given that the performance of the sheets after meets or exceeds the original manufacturer standard, we feel confident that the material can be counted on to function well indefinitely. We will continue to expose and periodically test the sheets in this sample.

UV blocking glass sheets, which incorporate thin films and laminates, are worth studying as well as the acrylic sheets we tested in this study, since their aging characteristics may differ. As we test UV blocking glass sheets that have been in use for ten or more years we will publish the results on our website.