Frank Lloyd Wright furniture: A technical study of objects from the Darwin Martin House

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ABSTRACT: The purpose of this study was to investigate the upholstery, construction and finishes of three pieces of furniture from the Frank Lloyd Wright-designed Darwin Martin House in Buffalo, New York. These pieces include a table, chair and sofa. Along with examination for physical evidence, methods of analysis included X-radiography to determine construction techniques, Fourier Transform Infrared Spectroscopy (FTIR) to identify the organic materials present in the finishes, and with ultraviolet light and microscopy to aid in determining the finish. Samples were taken from the back, arms and sides of a sofa, a chair splat and the top and base of a table. Historical research was also done on the materials used and the manufacture of furniture during this time period.

Introduction

THE FINISHES THAT ARE THOUGHT TO be original on this furniture are very fragile and not easily identified. The design and manufacture of Frank Lloyd Wright furniture during this period (early twentieth-century) is consistent with the furniture made in the style of the Arts and Crafts. A large amount of experimentation for finishing techniques and materials occurred at this time. Finishers were following the particular aesthetic of the Arts and Crafts period, and what may have been thought to be stable finishing materials are showing signs of considerable deterioration. It is imperative to understand what these materials are to treat and preserve them properly. Experimentation with the construction of furniture occurred as well at this time. These objects are made with techniques that are much more complex than would be expected with the Arts and Crafts philosophy.

Materials and Techniques Background

Frank Lloyd Wright favored minimal finishing of wood and admired the look of Japanese finishes. In one quote he says, "strip the wood of varnish and let it alone—stain it." He also felt that the silken texture of wood was vulgarized by varnish having an unacceptable sheen. He stated, "wood best protects itself and that a coating of clear resinous oil would be enough." Another reference included a statement by Wright that "Furnishings should be an extension in the sense of the building in which they furnish."

The principles of the Craftsman furniture were not far from Wright's and were based upon honesty and simplicity. The inventor of Craftsman furniture, Gustav Stickley, felt that the furniture being turned out in great quantities by the factories was "badly constructed, over-ornate and meaningless." He sought to make strong, simple and comfortable furniture. Stickley chose white oak for its sturdiness and beauty, and the furniture was constructed to last several lifetimes. The first of the Craftsman furniture was built in 1898, and was presented to the public in 1900. Catalogs of Stickley furniture from 1904 describe finishes giving a choice of "Craftsman Fumed Oak, Silver Gray Maple and Mahogany." The "Fumed Oak" finish is stated as giving the wood the look of age, without injuring its natural qualities. It was felt that the raw wood lacks "mellowness" which is obtained over time and weathering. The beauty of the grain is preserved as well as enhanced, and it accentuates the "watered" pattern-like effects which run through its texture. The wood should be treated so that there is little evidence of an applied finish. Oak should be ripened by fuming with ammonia which has an affinity for

the tannic acid in the wood. It darkens the soft areas of wood as well as the dense rays, coloring in an even tone.

The Craftsman catalog includes a description of the method of fuming oak. After it has been moistened to open the pores, the wood is placed into an air-tight box or closet with a dish of ammonia. Usually 48 hours is enough to color the wood depending on the size of the compartment. The more tannin present, the darker the result will be. A "touch up" may be necessary by mixing a brown aniline dye dissolved in alcohol with German lacquer "banana liquid" (amyl acetate). Cheese cloth is used to blend the stained areas with the fumed areas. Afterwards, a touch-up coat of lacquer is applied made of 1/3 white shellac and 2/3 German lacquer. It is advised to apply two coats of lacquer, each containing a little color, to sand in between each coat and to apply one or more coats of prepared "floor wax." A last rubbing of "Craftsman Wood Luster" is suggested, which is likely wax. This gives a soft satiny luster to the surface of the wood.

A Sherwin-Williams Company ad from a 1906 Craftsman catalog gives directions on "How to Finish in True Craftsman Style" interior woodwork and furniture. They named all their finishing products "Sherwin-Williams Handcraft Stains." Several colors were available: Weathered Oak, Cathedral Oak, Tavern Oak, Flemish Oak, Brown Oak, Old English Oak, Fumed Oak. Their directions for securing the true Craftsman finish suggest that the wood should be clean and smooth. The "Handcraft" stain should be applied to bare wood with a soft brush and allowed to stand overnight. Next it should be lightly gone over with steel wool or fine sand paper. A coat of Sherwin-Williams Mission-Lac (what the company refers to as a superior substitute to shellac as well as being cheaper) should then be applied. This will dry hard in three to five hours. Finally, the surface should be sanded lightly again giving a rich, soft, velvety effect.

The Matthews Manufacturing Company of Milwaukee, Wisconsin, founded in 1857, was referred to several times in letters between Wright and various contractors. They were responsible for almost all of the interior trim and cabinet work as well as the furniture in the Darwin Martin House. It is likely that the finishes described above were similar to what was used by the Matthews brothers on the Frank Lloyd Wright furniture. The owner, Darwin Martin, kept a detailed journal which included recipes for mahogany and fumed oak finishes. There are descriptions of the application of stains, both water and oil-based, sanding, and the application of shellac or varnish.

Historical Background of the Darwin Martin House

The prominent twentieth-century architect, Frank Lloyd Wright, was responsible for designing nine buildings in Buffalo, NY between 1902 and 1927. Darwin Martin, an executive of the Larkin Soap Company, was responsible for introducing Wright to many of his Buffalo commissions. These included a home for Martin's sister-in-law and then a home for Martin and his family, in which a conservatory and stables were built as well as a walkway extending from the main house to his sister-in-law's house. Frank Lloyd Wright's design of the Martin House included furniture as well as a furniture layout.

The Martin family left the house after Darwin Martin died in 1935. By 1940, it had started to show signs of deterioration. The house and property were sold at a tax auction to the city of Buffalo for $394.00. In 1950, the house was purchased by a Buffalo architect, Sebastian Tauriello, who saved the main house. The walkway, conservatory and garage were not saved. The house was acquired by the State University of New York at Buffalo in 1967. Since then, there have been ongoing efforts to preserve the house. In 1994 it was designated an Historic Site, making it the 35th such site in the state of New York.

Sixty pieces of furniture for the Darwin Martin House designed by Wright, as well as some Stickley pieces approved by Wright for the house, have been brought to Peebles Island Resource Center to receive conservation treatment. The collection is significant, for the objects contain areas of original finish. The furniture suffered abuse over the years but has held up well with only some loose veneer, grime and replacement upholstery.

Objectives

The object of this study was to examine the construction and finishes on three pieces of

Frank Lloyd Wright furniture from the Darwin Martin House in Buffalo, New York and determine construction techniques as well as finishing techniques and materials. This knowledge will aid with the preservation and treatment of other objects from the Darwin Martin house as well as similar Frank Lloyd Wright furniture from this period.

Procedures, Materials and Methods:

A. Design, Description and Construction:

Table

The table was originally located in the library of the house. It stands 29" high and 21" wide. There are four casters, one under each foot, made up of a ball in a cup allowing it to roll freely. Construction found in the table using solid cores and thick oak veneer surrounding the core is similar to construction described in the L & JG Stickley Craftsman Catalog. The top appears more red and more glossy than the lower portion of the table.

Chair

The chair was designed for the dining room of Wright's Heath House, also in Buffalo, but was later moved to the basement of the Martin House when the architect Tauriello lived there in the 1960s. The chair is 43" high and 16" wide. The joinery is mortise-and-tenon, the back is a solid oak board, and there are metal glides on the bottom of each foot. The upholstery is a printed pile fabric replacement show cover on a slip seat and is very faded and worn. The under-upholstery is original cotton batting, moss, horse hair and webbing, which was sagging.

Sofa

The sofa, one of a pair, was designed to go in the library of the Martin House. It is 32" high and 73" wide. The frame is constructed of solid oak as well as veneer. The upholstery is a replacement gold velvet cover with two small loose pillows. The brackets on the sides of the back panel were loose, and they were removed to reveal construction as well as upholstery techniques. The brackets themselves are attached with two dowels and glue. After these were removed, screws were revealed running through the arm at a diagonal into the back panel. These unscrewed easily, and the back panel lifted out of the tongue and grooves.

B. Sampling

Finish was sampled from each area on the furniture that fluoresced differently under ultraviolet light. The samples were taken with a scalpel and were as small as possible. Scrapings were taken of the finish for FTIR analysis, and small cuts were made in the finish down to the wood for cross section samples. The samples were either placed in small glass vials with lids or mounted in polyester resin for cross sections and were labeled appropriately.

Samples were taken of both the top of the table and the base. The table top appears darker and redder than the base. The chair was sampled on the back board which appears similar to the table top. The sofa was sampled on the arms, the side panel and the back panel. The back panel appears more glossy and redder and is also less sensitive to the solvents tested.

C. Measurement and Data

The analytical techniques used to analyze the samples included X-Radiography, Fourier Transform Infrared Spectroscopy (FTIR), hand-held ultraviolet light, and microscopy. The FTIR analysis was performed in the Winterthur Conservation Department. All other analysis was performed at Peebles Island Resource Center in Waterford, New York.

The X-Radiography analysis was used to understand the construction techniques of the back panel. The back panel was removed from the sofa and placed onto an X-ray machine by CGR Medical Corporation modified for flat objects. The X-ray was taken at 60 KV and 50 MA for four minutes. The FTIR analysis was performed using the Analect RFX-65 with the XAD microscope. The FTIR data aided in the identification of the principal organic components in the finishes. The samples were run with 200 scans with a gain of either 2 or 2R. The FTIR microscope was used, and therefore only very small samples were necessary. The samples were placed onto the diamond cell under a microscope and were flattened using a metal roller. The diamond cells were then placed under the FTIR microscope, focused, and an area was chosen with the aperture. A background test was run on a clean area of the diamond cell, and then the sample spectra were run. The gain and

scans were adjusted as needed. Once the spectrum was acquired, the baseline was corrected and spectra were plotted out. Ultraviolet light analysis was performed using a hand-held black light (365 nm). Microscopy was performed using white light as well as ultraviolet light under 100X and 200X using an Olympus Vanox microscope. The samples were mounted in polyester resin, allowed to dry under a tungsten bulb for four hours and then sanded and polished using Micromesh.

D. Analysis and Evaluation

The FTIR spectra obtained were compared to known reference spectra of finishes. The additional data were also compared to the research of materials and techniques used in finishes of this period.

David Bayne of Peebles Island was present when the samples were taken. Examination with ultraviolet light was done in conjunction with solvent tests first because it is non-destructive. This information was compared to the analysis obtained from FTIR and cross sections. The sofa was too large to fit into the X-ray room. The back panel, however, was easily removed which provided an abundance of information. Samples of finish were taken from an identical sofa, also part of the Darwin Martin House collection, and were found to be the same. These samples provided stronger spectra, providing more information.

The project was supervised by David Bayne, Furniture Conservator at Peebles Island. Janice Carlson, Senior Scientist, Winterthur Museum, aided in the use of the Fourier Transform Infrared Spectroscopy. She also assisted in the interpretation of the data gathered.

Results and Discussion

A. Ultraviolet Light Analysis

When examined with ultraviolet light, the table, the sofa side panels and the chair rails, thought to carry the original surface coating, fluoresced in a characteristic greenish-white as well as red undertones. The coatings from these areas were all similarly soluble in polar solvents such as alcohol and water as well as non-polar solvents such as mineral spirits. The back of the sofa and the lower side panels appeared to be refinished because the finish was more stable, was not soluble in mineral spirits and had a slightly orange color. The other areas thought to be refinished as well—the arms, table top and chair rails—all fluoresced a bluish-white color.

B. X-Radiography

The X-ray was taken of the proper left top corner of the back panel. It revealed boards making up 5-ply lumber core as well as separate mitered boards connected to the lumber core with tongue-and-groove construction. There are two dowels joining the mitered boards together. Moss, horse hair and upholstery nails were also apparent in the X-ray. The upholstery understructure was attached with nails to the back board equal distances apart from each other. (*fig. 1*)

C. Microscopy

Cross sections of areas that were thought to be original, such as the table base and the side panel of the sofa, show a creamy-white fluorescing finish (possibly two applications) with a thin layer of dark

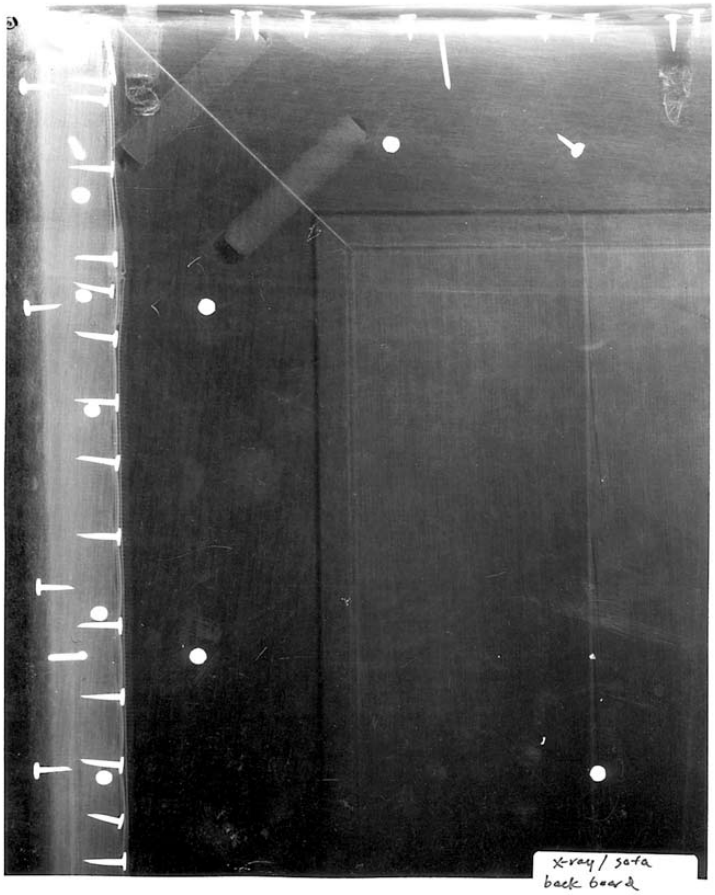


Figure 1: X-ray of Proper Left corner of the back panel of the sofa.

particles on top. The sample from the back of the sofa showed two applications of a fluorescing yellowish-white finish as well as a thin layer of dark particles on top. The thin layer of dark particles on each sample was either a dirt layer or a thin, non-fluorescing stain applied on top of the finish. Samples from the arm of the sofa showed a yellow fluorescing layer, a bluish-white fluorescing layer, a brownish-blue layer, and dark particles on top. The table top also showed a bluish-white layer, but with particles incorporated into it and a dark layer underneath.

D. Fourier Transform Infrared

The spectra acquired from the supposedly original areas were all similar and rather complex. The primary component appears to be a natural resin, possibly shellac. There was also evidence of oil, likely a drying oil. Several of the samples exhibited a group of bands around 1060 as well. This region of the infrared spectrum is particularly difficult to interpret because a number of materials—organics such as ethers and inorganics such as silicates, phosphates and sulfates—strongly absorb here. In addition to natural resin and oil components, the original finishes all contained a cellulosic component. In particular it was found in the coating from the sofa side panel. The cellulosic bands were so prominent that a computer spectral search came up with cellulose itself. Cellulosic materials have been used as the primary starting materials for such coatings as nitrocellulose and cellulose acetate. However, these materials were not used commonly until the 1920s, and the typical peaks did not show up in the spectra. One explanation is that it could be a cellulosic component added to the stain as a binder, such as gum arabic. (*see fig. 2, 3 and 4*)

Infrared spectra of what was believed to be refinished areas showed them to be quite different from the areas of presumed original finish. The coating from the splat of the chair produced an infrared spectrum which compared favorably to a polyurethane in both computer and manual spectral searches. The material found on the table top was identified as a silicone varnish.

FTIR can only provide general classifications for organic compounds. In order to identify the specific natural resin or oil component of the finish, one must use a technique such as Gas-Chromatography-Mass Spectrometry to separate these components first. FTIR does show us, however, that the original finish on these objects contained a mixture of natural resin, oil and a cellulosic component as well as inorganic materials.

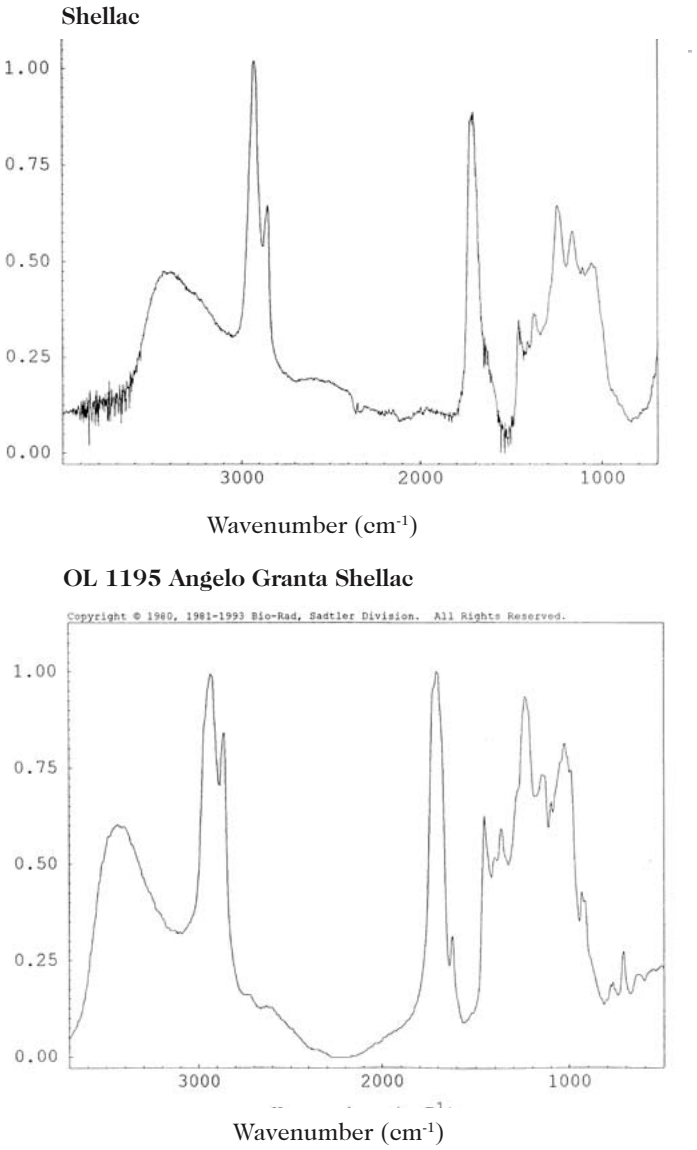
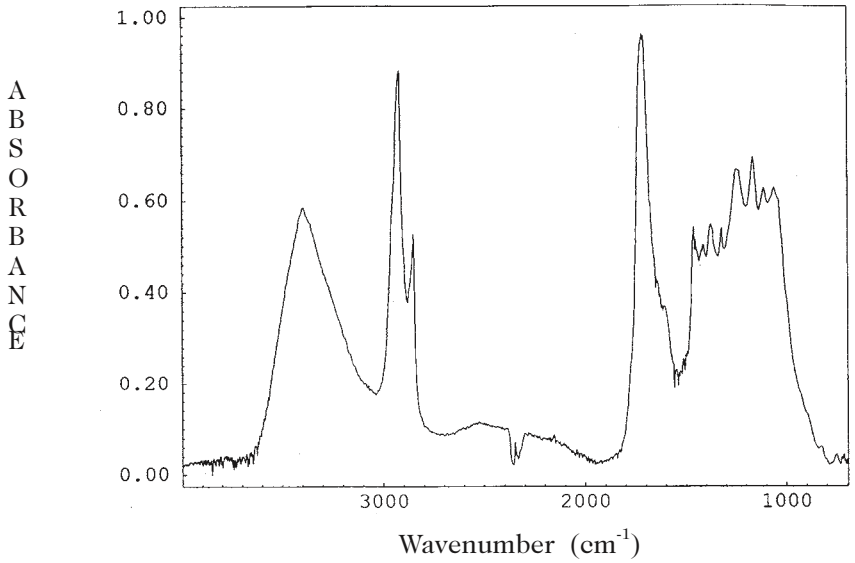


Figure 2: Comparison of shellac versus Angelo Granta shellac on Table base/old FLW92B.

Conclusions

The finishes on the sofa side panel and the table base were found to contain similar materials as found in the historical references for finishes at the turn of the twentieth century. They contained

Shellac/Cellulose



OL1195 Angelo Granta Shellac

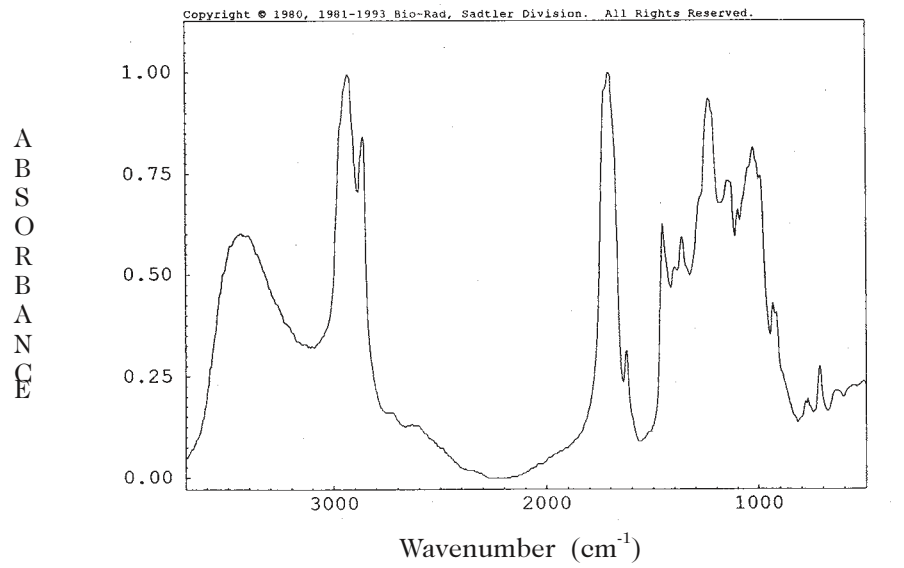


Figure 3: Comparison of shellac/cellulose versus Angelo Granta shellac on sofa/side panel/old 6B.

a mixture of oil, natural resin, possibly a cellulosic binder and inorganic materials (likely pigments). The chair back, table top and the sofa arms were found to have later synthetic finishes, both silicone and polyurethane.

Most Frank Lloyd Wright furniture as well as interior moldings have been refinished with no attempt at saving the original coating. The Darwin Martin house is an excellent resource to aid in understanding the original appearance of Frank Lloyd Wright Prairie Houses. The data obtained from this study is extremely helpful in identifying the materials used in the manufacturing of this furniture, and this knowledge gives insight to understanding the deterioration of the finish. It will aid in the treatment of similar objects to allow cleaning without removing original materials.

Revealing the construction of the furniture allows us to place the objects in context with a particular time period and the Arts and Crafts style. It also gives us more insight into the practices of building Arts and Crafts furniture that do not necessarily match the philosophy of the period such as plywood, veneer and dowels. We are able

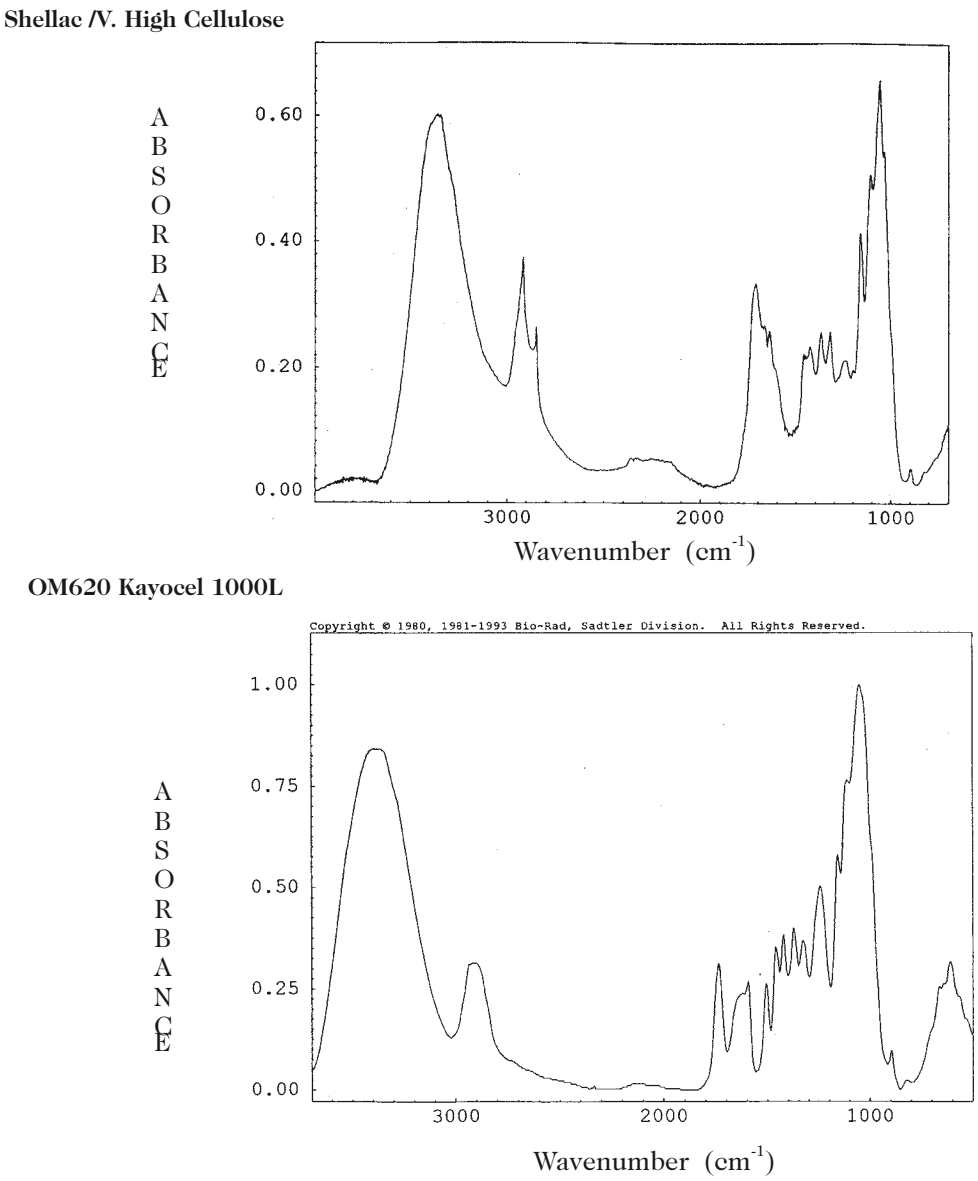


Figure 4: Comparison of shellac/v. high cellulose versus OM620 KAYOCEL 1000L on sofa/side panel/old FLWS2B.

to understand the structural wear or lack thereof in these objects, as well.

Acknowledgments

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End Notes

1. Patterson, Terry L. 1994. *Frank Lloyd Wright and the Meaning of Materials*. University of Oklahoma: Van Nostrand Reinhold.

2. Ibid.

3. Wright, Frank Lloyd, 1960. *Writings and Buildings.* New York: New York Horizon Press.

4. *Gustav Stickley's Craftsman Catalog*, 1904.