# ABRASIVENESS OF PACKING MATERIALS

A Preliminary Research Project Report

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**Abstract**

Artifacts are being moved and shipped with increasing regularity for a variety of reasons. Many studies have evaluated packing materials for vapor permeability, residual offgassing, etc., but not for potential mechanically induced damage due to abrasion resulting from contact between the artifact and the packing material. An ongoing research project at CAL began investigating the problem and a report of current findings will be presented. This will include a review of experimental design, the packing materials tested, and experimental procedures.

**Introduction**

Research to date has emphasized on three main areas: vapor permeability, residual chemical effects and environmental buffering. In reality, the choice of packing material must be based on several concurrent factors, namely price, availability, working characteristics, durability, and physical and chemical properties. While price and other pertinent supply information can be easily obtained, and most packing materials have been evaluated for chemical properties, the physical interaction between packing materials and artifacts has not been adequately studied.

After consultation with individuals knowledgeable in packing materials studies, we were surprised to find that little, if any, attention has been paid to the abrasive effects of packing materials on the surfaces of artifacts. With that in mind, the CAL Furniture Lab in conjunction with CAL Organic Chemists undertook a project to evaluate a variety of packing materials solely on the basis of their abrasiveness in contact with furniture finishes.

Due to the current nature of the research, this paper will emphasize the basic organization of the experiment and the experimental procedures. While the date of this paper (early 1988) precludes conclusions based on data, substantive information will be available by the time the New Orleans conference occurs.

One of the main purposes of this paper is to promote the idea that fundamentally important research is possible without extreme financial outlay. While this research was conducted with all of CAL's resources at our disposal, we will point out the possibilities available to researchers who lack such resources.

We hope this will encourage colleagues to pursue research in the area of furniture conservation. Most important to this quest is a careful definition of the question and the clarification of means by which the question will be answered. In other words, the important thing is the project design. The most elaborate analytical equipment cannot salvage a poorly designed experiment, but a well designed experiment can succeed, given only the most rudimentary support.

**Experimental**
Because this research is sponsored mainly by the Furniture Lab at CAL, it was important to focus on packing materials and finishes associated with furniture. After careful consideration, the following were chosen:

**Finishes**
shellac
oil/resin varnish
cellulose nitrate
Acryloid B-72

**Packing Materials**

| | |
|---|---|
| glassine | muslin |
| kraft paper | polyethylene |
| polyester backed PTFE | expanded foam |
| mylar | tissue paper |
| flannel | synthetic fabric |

The goal of the experimental procedure was to combine easily prepared samples with uniform testing conditions so that all materials could be fairly evaluated. The basis of the testing was to rub packing material samples against the surface of a finish for a specific period of time, at an arbitrary (but identical) speed, and at a specific load (weight). In addition, we wanted to evaluate samples for different times and loads of testing to determine if thresholds were in effect, i.e. was a particular material safe for minutes but not for hours, or non-damaging under one pound but destructive under ten pounds, etc.

The evaluation of the samples was conceptually very simple and consisted of three quantifiable factors.

1. Weight loss due to abrasion.
2. Dimensional change due to abrasion.
3. Optical change due to abrasion.

Measuring these effects, particularly the first two, required little analytical sophistication. Weight loss could be measured by weighing the test plates before finish application, after the finish had cured, and after abrasion was complete. Similarly, dimensional change could be determined by micrometric measurements at the same times, and optical changes could be judged by reflectometric measurements before and after abrasion.

Based on these guidelines we devised the following experimental procedure.

1. To assure identical substrates for the test finishes, all plates were glass. (244 plates were required: 10 packing materials X 4 finishing materials X 2 loads X 3 reps each + 4 control plates =244).

2. Each plate was numbered, weighed, and coated using a drawdown jig of our own manufacture (60 plates per coating material).

3. Following curing the plates were re-weighed to determine the weight of the coating. Reflectometer and micrometer readings were also taken.

4. Half of the plates were abraded for three different time periods with weight, micrometric and reflectometric measurements taken at the end of each time period.

5. The second half of the test plates was similarly abraded and measured as the first half with the difference of (additional load on this second group.

6. Calculate the data and evaluate for changes in weight, dimension and gloss due to abrasion.

Determining the times and loads for the testing was done by preliminary testing to determine limits of both which would cause the desired damage without completely destroying the sample or the test surface.

**Conclusion**

By numerically evaluating the abrasion damage caused solely by packing materials in contact with artifact surfaces, we are providing an additional factor to consider in choosing a packing material. It is not our desire (and hopefully not the result) to endorse or discourage one packing material versus another, but rather to evaluate <u>one</u> of the many characteristics each material possesses. We feel this information can be critical to conservators and other caretakers of historic artifacts faced with the responsibility of preparing artifacts for transit or storage.

| sample # | coating material | weight coating $T_0$ | coating reflectivity $T_0$ | coating thickness $T_0$ | abrasion Load | abrasive | wt. coating after $T_1$ | % wt. loss from $T_0$ | reflectivity after $T_1$ | reflectivity change $T_0$ | thickness after $T_1$ | % thickness loss after $T_1$ | wt coating after $T_2$ | % wt loss from $T_0$ | reflectivity after $T_2$ | refl. change from $T_0$ | thickness after $T_2$ | % thickness loss after $T_2$ | wt. coating after $T_3$ | % wt. loss from $T_0$ | reflectivity after $T_3$ | refl. change from $T_0$ | thickness after $T_3$ | % thickness loss | | | |
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## COATINGS

S = shellac

C = cellulose nitrate

O = oil/resin varnish

B = B-72

## ABRASIVE

1. glassien
2. Kraft paper
3. polyester backed PTFE
4. mylar
5. Flannel
6. muslin
7. polyethylene
8. expanded foam
9. tissue paper
10. synthetic fabric

# SAMPLE DATA WORKSHEET