

The Efficacy of Microchamber Boards in Passepartout for Paper-Based Art

SUMMARY

Microchamber board was introduced with dramatic examples of its ability to protect against acute exposures to gaseous air pollutants in experimental conditions. In contrast, the efficacy of the SPZ zeolite-containing boards used over long periods for display or storage in museum and archive environments has not been well documented.

We addressed this concern by comparing changes in appearance of light-sensitive materials sealed for over a year in passepartouts (Blyth-Hill 1991) assembled with Microchamber boards or with regular archival mat boards. We first tested the relative safety of Microchamber boards with light-sensitive objects sealed individually in this microenvironment. In a second study, the boards were challenged by including in the passepartout some materials which off-gas potentially deleterious volatile substances.

In both experiments, six sets of passepartout were prepared, three matted with Microchamber board, and three with regular archival museum board from the same manufacturer. One set of samples in each board was kept in the dark for fourteen months. These packages were opened occasionally for appearance measurements, and then resealed. The rest of the samples were placed in a north-facing window. One set of samples in each board remained sealed for the entire fourteen months. The other was opened periodically for appearance monitoring, and then resealed. This procedure was not intended to test the ability of the Microchamber board to prevent light-induced appearance change. Rather, the aim was to compare over time, in non-ideal display conditions, the appearance of the materials in the presence of each type of board in the sealed enclosures.

Reflectance spectra of all samples were measured with an X-Rite 938 spectrodensitometer. Repeat measurements of light sensitive sample materials had been made to ensure that multiple exposures to the instrument flash lamp did not itself cause significant change. The results were evaluated for differences in reflectance of samples in the Microchamber board and regular mat board. Trends in appearance change, as indicated by changes over time in the CIE $L^*a^*b^*$ values calculated from the reflectance data, were also followed.

Samples used in the first experiment were Blue Wool cards, newsprint, black and white resin coated silver-gelatin photographs, black oil stick applied to rag paper, and erythrosin-dyed, gelatin-sized Whatman 1 paper. No significant changes in appearance were observed in any of the samples kept in the dark. Changes in samples exposed to light in the passepartout with the two different boards were statistically indistinguishable. Opening the passepartout briefly for reflectance measurements did not appear to affect the appearance of the samples by the end of the experiment. We conclude that during long term storage Microchamber board does not have a deleterious effect on the appearance of the materials used in this test. However, this experiment did not include potentially harmful volatile substances in the passepartout.

In the second experiment, samples of chipboard, newsprint, color Polaroids, cellulose acetate film, and cellulose nitrate film were mounted in the passepartout in various combinations. The appearances of all of the materials except the chipboard were followed over fourteen months, as in the first investigation. Also, samples of the SPZ zeolite powder used in the Microchamber board were enclosed in Hollytex bags and sealed in regular mat board passepartout with each material that contained volatile substances. The powdered samples were evaluated for adsorbed gases after fourteen months, using pyrolysis-gas chromatographic analysis.

Compelling evidence that the Microchamber board conferred a clear advantage over regular mat board was not

observed during the fourteen months of this study. The cellulose acetate and cellulose nitrate films had not yet reached the auto-catalytic stage of degradation, and were not off-gassing enough acetic or nitric acid to be detected by odor. They did not undergo significant changes in appearance during the course of the experiments. A darkening of all the Polaroid samples occurred initially. This was overtaken by bleaching in all samples exposed to light. Appearance change in the Polaroids appeared to be independent of which mat board and what other sample material was present. Overall, the changes were not consistently smaller in the Microchamber board passepartout.

Other results were suggestive of the possibility that the Microchamber board could provide a protective effect for newsprint over a much longer time period than that of the experiment. The newsprint samples kept in the dark in the presence of cellulose acetate, cellulose nitrate, or chipboard were beginning to show a very slight trend of darkening in the regular mat board passepartout, as compared to the Microchamber board passepartout. Monitoring would need to be continued for a much longer time period to confirm that these differences were due to the different boards used.

Surface and bulk samples taken from the powdered SPZ zeolite sealed in the passepartout were subjected to elemental analysis for nitrogen and carbon content by pyrolysis-gas chromatography. These elements were detected as N₂ and CO₂ using a thermal conductivity detector calibrated with a sulfanilamide standard. The presence of significant amounts of carbon or nitrogen would indicate that volatile organic material and/or nitric acid had been adsorbed. An unused sample of powdered zeolite served as a blank. The bulk samples did not differ from this blank. The surface samples all contained about twice as much nitrogen and carbon as the blank. This includes the surface sample of powdered zeolite from a passepartout that did not contain other test materials. These data suggest that the volatile substances in the chipboard, polaroids, and cellulose acetate and nitrate films were either not being adsorbed by the zeolite in significant amounts—or not reaching it.

The experimental results help to put the performance of Microchamber board in perspective. The SPZ zeolite has been designed to trap molecules of a certain size and charge; it will not effectively scavenge volatile molecules with significantly different properties. It is a passive scavenger; the molecules to be trapped must diffuse into the board. Little air circulation can be expected in the passepartout, so a significant concentration of volatile material—or a large concentration gradient—will probably be needed to drive the molecules into the board. Microchamber board should function best as a barrier between the object to be protected and the volatile molecule(s) to be trapped. This situation is more likely to

occur in an open storage area where air quality is poor, or in a space where air circulates and objects that off-gas deleterious volatiles *the zeolite can adsorb* are stored among *other objects* sensitive to the vapors.

REFERENCE

Blyth-Hill, V. 1991. Passepartout (stabilized humidity control package). *Book and Paper Group Annual* 10: 20–21.

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