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Mechanical Behavior of Animal Hides at Low Temperatures

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Low temperature treatment (often referred to incorrectly as “freezing”) of cultural material is a common method for eradication of museum pests. However, it has been thought that stretched (constrained) composite hide objects, particularly drums, were susceptible to damage from low temperature treatments. Therefore, this project was designed to study the effects of the low temperature on hide.

This study examined the mechanical and structural behavior of hides subjected to temperatures as low as 40 degrees below zero Fahrenheit. New and naturally aged samples were tested to determine the strength and modulus of elasticity of these materials, according to experimental protocols developed by Marion Mecklenburg at the Smithsonian Institution Museum Conservation Institute. Perhaps the most useful result of the research was that the thermal coefficients of expansion of the hides remained low under low temperature. The relative humidity was found to remain at a relatively constant level while the temperature changed, and the thermal coefficients of expansion were found to be extremely low; which indicates that the hides did not contract or expand during the treatment. Furthermore, while the hides tested were found to be considerably stiffer at low temperature, their strength increased substantially without the hides becoming brittle.

This project provided some useful and practical data. Low temperature treatment of constrained rawhide is not likely to cause damage. Unless extremely fragile, the age of the hide makes little difference to the effects of low temperature. Data from extremely fragile material was not collected, however as such materials would be particularly vulnerable to damage from external agents, particularly handling, they should be considered separately. Additional testing suggests that large changes in relative humidity, rather than temperature puts the objects at a far greater risk than sub zero temperatures.

Results are filed at Smithsonian Museum Conservation Institute (MCI) as: MCI Project 6178.

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