

Lined canvas paintings

Mechanical properties and structural response to fluctuating relative humidity, exemplified by the collection of Danish Golden Age paintings at Statens Museum for Kunst (SMK)

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Abstract

This work evaluates the lining history of the Danish Golden Age collection of canvas paintings from the nineteenth century at SMK, The National Gallery of Denmark, and seeks to understand the moisture sensitivity of the paintings before and after lining. This is done by chemical analysis and tensile testing samples from the tacking edges as well as lined mock-up samples. The ability of the different lining techniques to support canvas paintings is evaluated in terms of their initial stretching and during fluctuations of relative humidity.

Six different combinations of lining adhesives and textiles were examined. These included the adhesives Beva 371, Plextol D360, wax-resin, and glue-paste. The lining textiles were linen and polyester sailcloth. A naturally aged canvas painting and a modern painting were lined using these materials and methods. Testing of the lined paintings included uni-axial load-strain tests to assess the stiffness of the lined paintings. This was done to investigate what happens in the painting structure when a lined painting is re-tensioned or keyed out after stretching. Restrained tests demonstrate how the lined and re-stretched painting responds to changes in relative humidity.

Contrary to the usual assumptions it was found that wax-resin linings on linen canvas responded to high relative humidity (RH) with higher contraction forces than was the case before lining. The contraction was evident at RH levels as low as 65%. Because the adhesive fills the voids in the linen canvas (both the original and the lining canvas), the contraction due to fiber swelling was immediate. There is some evidence that the same observation applies for liquid Beva in linen canvas. The results showed further, that glue-paste lining on a linen canvas offered significant support to a painting at 50% RH but increased the stress level severely in dry conditions and offered no support to the painting at 70-80 % RH. This means that the traditional glue-paste lining techniques and the wax-resin technique in high RH seem to limit the advisable RH fluctuation in a cultural institution. Conversely paintings lined with the polyester sailcloth showed a somewhat increased resistance to RH fluctuations.

Lining on canvas does not provide an efficient alternative to RH control because a tensioned canvas cannot go into compression and therefore cannot protect the paint and ground layers against contraction forces. Stiffness in a lining at relevant moisture levels is decisive for how much the structure can contract. In many cases linings will actually necessitate tighter climate control than that needed for unlined paintings and this has been found to be true for the collection of Danish Golden Age paintings as well.