

Keywords: Modern paint, ageing, Py-GC/MS, FTIR-ATR, material characterization

P33 - Development of a framework for assessing the light stability of plastic objects in heritage collections

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The complexity of plastic materials found in heritage collections has created an issue in terms of their identification and preservation. Plastics can contain small amounts of various additives which can affect their stability. Additionally, light stability of plastics has not been at the forefront of heritage science research so far which has led to underinformed museum guidelines. It is also rarely known what types of plastics are present in collections in the first place and systematic analysis of all possible material compositions is not possible. Therefore, a prioritising approach was employed with the aim of identifying factors which have the most influence over light stability of common plastics. Through an extensive literature review and a series of accelerated light degradation experiments, five 'influencers' have been identified: polymer type, colourants, light stabilizers/antioxidants, impurities, and previous exposure history. Since polymer type cannot be used on its own to judge the light stability of a plastic, we investigated the effect of colourants. The selected pigments are known to have a sensitizing effect on certain polymers when exposed to UV radiation, however their influence under visible light, as found in a museum environment, has not been explored. Cellulose acetate (CA) and polypropylene (PP) were selected as two chemically different test polymers. The former is an unstable plastic of historic importance, while the latter is one of the most widely used polymers to date, which, nowadays, can also be found in collections but has not yet been much studied from a heritage perspective. PP is also known not to absorb visible light on its own but often contains impurities which can catalyse photodegradation even at longer wavelengths. Samples were exposed to intense visible light for 12 weeks (corresponding to 270 years on display at 200 lx, 10 hrs per day). Preliminary results show that, while some pigments do indeed accelerate oxidation of PP, it does not lead to significant physical changes to the material (such as discolouration or cracking). Future investigations will also look at the effect of previous UV exposure to account for museum objects having a previous history.

Keywords: plastic degradation, light stability, pigments, polypropylene

P34 - The challenge of time – Restoration of a 1960s PVC sculpture

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In the conservation of contemporary artworks the balance between content and form is complex and it is important to work on the material in order to respect the artist's idea and message. When dealing with plastic artworks, it is of paramount importance to carefully calibrate investigations and interventions as plastic presents subtle intrinsic balances and a slight variation could trigger unforeseen and unexpected outcomes. Moreover, being a fairly recent field of study, the literature on conservation plastic heritage is scant. The present work introduces the restoration of *Scultura Neve* (1965), a PVC work by Remo Bianco. The work consists of four plastic masks covered with an artificial snow finish and attached to a wooden support. The plastic was affected by deep fractures and the surface finishing was strongly dismantled. The procedures of consolidation, adhesion and the design of a new anchoring system are presented. The rationale and the analysis that led to the selection of materials and operational choices are exposed. Different series of mock-ups played an essential role in defining the procedural choices at the basis of the restoration intervention allowing a deep knowledge of the interactions between materials. The procedure of consolidation involved the adherence of the surface finishing. The bonding procedure was carried out through the testing of the mechanical properties and the aesthetic features of a range of products for the industrial treatment of PVC. To design a new system of anchoring 3D modelling and 3D printing

technologies were used, which turned out to have strong advantages concerning the needs and constraints of the treated materials.

Keywords: plastic conservation, interventive conservation, PVC, adhesion, 3D modelling

P35 - Towards conserving PMMA in art and design: investigating solvent impact and aging with nano thermal analysis

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Conservators treating architectural models, paintings, photographs, and sculpture made of poly(methyl methacrylate), or PMMA, requested guidance for safe solvents. Their key concern was the safety of xylenes in cleaning solutions, or as a diluent in adhesives, or inpainting and varnish mediums. Although the important plastic conservation publication POPART suggested xylenes for cleaning assessments of PMMA, manufacturers and various authors have identified risks with this solvent. In a previous study by this author, transparent PMMA samples immersed in xylenes were slightly reduced in weight and initially clouded, but no visible damage was apparent after aging. In this study, the thermal properties of these samples were characterized to investigate the long-term impact of xylenes on PMMA.

This poster describes an investigation of glass transition temperature (T_g) behavior of transparent PMMA immersed in conservation solvents and aged naturally for 27 years. The T_g values of samples immersed for one minute or one hour in a commercial xylenes isomer mixture used in conservation, were compared to the T_g of samples immersed in acetone and toluene, two solvents known to dissolve PMMA. The sample-averaged T_g of the bulk material was characterized with Differential Scanning Calorimetry (DSC) and the surface T_g was investigated with Nano Thermal Analysis (nano-TA).

DSC detected no differences in the T_g of any samples, not even in those that were partly dissolved. However, nano-TA revealed slightly lower T_g values on the surface of the samples immersed in solvents, when compared to controls, suggesting solvent-induced swelling and polymer chain-scission. While further investigation is necessary, the results suggest that xylenes impact was similar to the solvents known to dissolve PMMA, even though no visible damage was apparent. These findings lead to questions concerning the reliability of solvent cleaning tests, and the long-term impact of xylenes in conservation treatments.

Nano-TA is a promising technique for the characterization of plastics in modern and contemporary art and design. The technique is useful for local characterization of surface T_g at nanoscale resolution distinctly from sample-averaged T_g of bulk material. Nano-TA allows rapid multiple measurements directly on samples; 10 readings were averaged in this study. In contrast DSC requires large samples and lengthy procedures.

Keywords: poly(methyl methacrylate) (PMMA), polymer chain scission, glass transition temperature (T_g), differential scanning calorimetry (DSC), nano thermal analysis (nano-TA), solvents

P36 - Use of PLA and ABS in 3D printing for Fine Art. Analysis of filament and print composition and long term behaviour

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3D printing refers to an *additive manufacturing* (AM) technique wherein a physical object is fabricated from a digital model, by binding material together to build up the final shape, usually in thin successive layers. The shapes that can be produced in this way can be extremely complex and impossible to manufacture otherwise, with