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Synchrotron Radiation based techniques for the study of altered metal foil coatings in Baroque altarpieces

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Baroque artists applied metal foils on altarpieces to produce colourful sparkling and shining light effects. Additionally, pigments or dyes were mixed with oils and resins and applied over the silver or gold foils to create also colour shades. However, the effect intended by the artist appears distorted by the alterations occurred over the years resulting from the chemical reactions among the materials themselves and with the environment. Besides, these processes are favoured by the environmental conditions in which the materials are kept. The silver foil itself reacts with the environment through the micro fissures open in the organic protection coatings producing silver sulphides and chlorides, which, while crystallizing, produce themselves stresses that enlarge the cracks resulting in a gradual loss of the metal layer. The study of the reactivity and stability of the metal foils, coating layers and adhesives which fix the foils onto the ground layers (often a bole) is essential to define restoration strategies. The samples extracted are very complex, to the original materials (bole, adhesives, metal foils, resins, drying oils, pigments/dyes, fillers and binders), reaction, weathering and aging compounds (i.e. carboxylates and oxalates) we have to add those materials incorporated by historical restorations and dirtiness. Furthermore, those substances are present in variable concentrations, and often in extremely low concentrations. Finally, the location and distribution of the reaction and aging substances in the different layers is also important and consequently, homogenizing and dissolving the samples is not adequate since this valuable information is lost. Synchrotron radiation based micro-sensitive techniques such as μFTIR and μXRD are outstanding to overcome the difficulties involved in the analysis. The cathedral of Tortosa, a few kilometres inland from the mouth of the Ebro river, contains a set of Baroque altarpieces made over a prolonged period of about one hundred years, the oldest dating 1671 and the newest, 1775. During this extended period the materials used and the techniques employed changed and those changes are manifested in the aging and alteration processes undergone by the artworks. The nature, reactivity and alterations of the green, red and amber protective coatings are studied.

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