

# Colour Enamels in the Modernist Catalan stained glasses from Barcelona

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Modernist stained glasses are a beautiful and fragile component of our Cultural Heritage. During the last years of the 19th century Catalanian glass makers were strongly influenced by the beauty of the large medieval and renaissance glasses that decorate the walls of churches and developed a new style that combines the use of glasses of different textures either coloured or transparent, but also made extensive use of enamels, consisting of a thin coloured glass layer fixed over a transparent base glass. The colour is given by the addition of metallic ions or of micrometric/nanometric pigment particles to the glass phase. In particular, Modernist enamels have been found to have a lead-zinc borosilicate glass (30-40 mol% PbO, 10-30 mol% B<sub>2</sub>O<sub>3</sub> and 0-20 mol% ZbO) which has a low softening temperature (between 580 °C and 620 °C), adequate to fix the enamel to the base glass without affecting its mechanical integrity [1] and which are fairly stable to water corrosion. The applied enamels form a thin layer measuring from a few to some tens of micrometers. Due to its functional use as a windows of buildings the stained glasses have been exposed to the weathering and to the effects of the solar exposure for more than 100 years and today we can observe an evident degradation in some of them. The aim of this paper is to present the results of the research we have done from a collection of historical modernist stained glasses produced by the most important modernist workshops from Barcelona in close collaboration with J. Bonet Vitralls S.L., a company dedicated to the production and reparation of stain glass. LA-ICP-MS has been performed to determine the chemical composition of the enamels and SEM and micro-XRD to determine the micro and nanocrystalline compounds present in the layers, including the original pigment particles, reaction compounds produced during the fixing of the enamels to the base glass and the compounds formed due to the alteration/weathering of the enamels. The identification of the micro and nanocrystalline compounds present in the enamels together with the weathering compounds formed gives clues about their role in the degradation of the layers. Finally, it is also important to determine the presence of compounds which may compromise the stability of the decorative layers in order to propose strategies for its conservation.

## References

[1] - M. Beltrán, F. Brock and T. Pradell, "Thermal properties and stability of Catalan Modernist blue and green enamels", *International Journal of Applied Glass Science*, Vol 10, Issue 3, 414-425 (2019).