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## Development of New Radiation-Curing Monomers-Resins Systems for the Consolidation of Wooden Cultural Heritage Artefacts

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The styrene unsaturated polyester resin is implemented so far by ARC-Nucléart Conservation Centre for the consolidation of degraded wooden artefacts from cultural heritage, following a process so called "Nucléart" by liquid state resin impregnation under vacuum/pressure, and in-situ polymerization of the resin under gamma irradiation. However, this method is irreversible due to the crosslinked solid state resin which is insoluble in any solvent, and moreover, the consolidation of wood by such 100 % reactive resin fills almost completely the wooden pore structure, creating in fact a wood-plastic composite which densities are much higher than untreated wood ones. These features are the drawbacks of the method because in conservation-restoration of art objects, the two well-known criteria among others are the reversibility of the products and the minima intervention in order to avoid the denaturation of the original and unique object.

Having proven during many decades its effectiveness for saving from destruction numerous highly degraded artefacts, another drawback of the actual process is the more severe regulation in terms of safety, toxicity when using the styrene monomer, without considering its high vapour pressure and its residue in treated artefacts even after long periods of storage or display. For these different reasons, the aims of our research are the improvement of our radiation method in two directions: the application of already available styrene-free resins, and the development of hydroxyl-acrylic monomers which polymers are in principle reversible, respecting one of the most important criteria in conservation. In this paper, we will describe first the irradiation conditions to overcome the inhibition effect of oxygen on the complete curing of the resin or monomers, the formulations of monomers in order to obtain polymers with the most appropriate Tg (around 40° to 60°C), and their polymerization in selected solvents in order to modulate their content in the wood. Structural characterizations are carried out by using FTIR and solid state NMR spectroscopies. The second part of our work will present the impregnation of two species of wood, beech and fir, by the styrene-free selected resin and by the monomers. They are characterized by various techniques such as colorimetry, dimensional changes, radiography, computerized tomography, and mechanical resistance. Last but not least, the interaction or not of the resins or monomers with various polychromies (pigments, colorants) has to be checked, and it is important to assess the feasibility of their implementation in consolidation of samples of sacrificed artefacts presenting gilded or polychrome surface layers.

### Country/Organization invited to participate

France

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