



Contribution ID: 304

Type: Oral

Application of Ionizing Radiation for Cultural Heritage

Wednesday, 26 April 2017 12:35 (20 minutes)

Ionizing radiation has specific and indisputable advantages over classical procedures for conservation and preservation in Cultural Heritage, such as no risk for the operators, no toxic residues and hence no risks for curators, visitors or the environment. This technology can replace the traditionally used toxic or carcinogenic gases such as methyl bromide or ethylene oxide, eliminating the associated health problems and environmental pollution. Large amount of bio-deteriorated objects can be treated in a short time with excellent reliability, using controlled and codified procedures. The evaluation of the often not reversible physical-chemical modification induced by ionizing radiation on treated materials, namely side-effects, represent an important goal to guarantee the safeguard of the artifacts and the reliable diffusion of this technology. Irradiation procedures and characterization methodologies will be assessed for the conservation and preservation of archives materials and for the consolidation and protection of porous artefacts. Defined irradiation conditions (in term of irradiation dose and dose rate, environmental atmosphere, pre-treatment of the cultural heritage object) and the proposal of shared guidelines are extremely desirable. The ENEA activities regarding the application of ionizing radiation in Cultural Heritage performed at Calliope plant are focused on conservation and preservation (bio-deteriogen eradication in archived materials) and on consolidation and protection (degraded wooden and stone porous artefacts consolidation). The biocide effect of gamma radiation has been confirmed on selected papery materials at dose effective for the treatment and the harmful effects on the irradiated materials have been demonstrated. With the aim to be effective for disinfestation, microbiological studies about the dose rate and atmosphere (air and inert gas) effects on gamma irradiated archived materials have been performed. Irradiation side-effects on paper have been also investigated by chemical and spectroscopic techniques (DP, FTIR, ESR). Different atmospheric and biological agents induce severe and somewhat irreversible degradation phenomena on wooden or stone artefacts (i.e. porous materials). Consolidation and surface protection of these degraded objects is usually obtained by the application of natural or synthetic consolidating agents but the penetration inside the porous material it rather difficult, limiting the effectiveness of the treatment. Impregnation of cultural artefact with a diluted solution of consolidant precursors (i.e. low-sizes monomers or oligomers) followed by radiation induced in situ polymerization represents a very promising solution to achieve actual bulk strengthening. Formulation of different polymeric composition for the consolidating agents to improve their strengthening efficacy and safeguard towards the cultural object has been investigated, modifying their features by gamma irradiation and aiming to increase their functional, chemical and time stability. Particular attention has been paid on the solvent compatibility, aiming at employing environmental friendly and not harmful to the health substances. Characterisation by means of different techniques (optical measurements, FTIR, ESR, NMR, mechanical tests) has been carried out to evaluate side-effects and the post-irradiation behavior. Standardisation of irradiation procedures and methodologies by a correct choose of irradiation parameters and their reliability and reproducibility has been verified and supported by dosimetric measurements.

Country/Organization invited to participate

Italy

Primary author: Ms BACCARO, Stefania (ENEA, Italy)

Co-author: Ms CEMMI, Alessia (ENEA, Italy)

Presenter: Ms CEMMI, Alessia (ENEA, Italy)

Session Classification: A09

Track Classification: MITIGATING THE IMPACT OF CLIMATE CHANGE