Short Term Scientific Mission, COST IE0601

Beneficiary: Dr. Mihalis Cutrubinis, Horia Hulubei National Institute of Research and Development for Physics and Nuclear Engineering
Host: Dr. Quoc Khôi Tran, Atelier Regional de Conservation NUCLEART, CEA Grenoble
Period: from 13/04/2008 to 19/04/2008
Place: Grenoble (FR)
Reference code: COST-STSM-IE0601-03617

Mission Report

Mission purpose:

Training on using nuclear techniques for the conservation of wooden cultural heritage objects. The two main applications of gamma irradiation process are the disinfection of wooden objects and the wood structure consolidation by impregnation with a radiation-curing resin. This mission will allow Dr. Cutrubinis to develop these applications in his laboratory and for further cooperation with European laboratories.

Mission work plan:

1) Visit of the facilities
2) Testing consolidation of degraded wood sample by impregnation with a radiation-curing resin (styrene-unsaturated polyester resin) following vacuum/nitrogen pressure process. Radiation polymerisation of the resin inside the wood sample by gamma rays. Monitoring of the irradiation phase. Dosimetry. Characterisation of the treated wood after irradiation.
3) Disinfection and insect eradication aspects of wooden objects by gamma irradiation. Effects of gamma irradiation on polychromies.
4) Other processes for the conservation of archaeological wood.
5) Feedback, conclusions of the visit.

Mission description:

At the beginning of the mission, I have visited with my host the facilities of Atelier Regional de Conservation NUCLEART (CEA Grenoble, France): the Co-60 irradiation facility (irradiation chamber and dosimetry laboratory), the styrene polyester resin impregnation equipment for dry wood, the polyethylene glycol (PEG) impregnation / drying facilities for wet archaeological wood and the conservation / restoration workshops.

After discussion with the host, two work directions have been established:

1. Colour measurements of wooden polychromies before and after disinfection by irradiation, and

2. Consolidation of degraded wooden samples by resin impregnation followed by irradiation.

Concerning colour measurements, 80 samples of wooden polychromies prepared in Romania and France have been measured using a Minolta Spectrocolorimeter CM-508i. The same samples will be also measured in Romania using a Hunter Lab Spectrocolorimeter MiniScan XE Plus. The purpose of these measurements is to intercompare the colour measurement results and expand the expertise of the two research teams in the field of disinfection of wooden polychromies by gamma irradiation.

Concerning consolidation of degraded wood by resin impregnation / irradiation, wooden samples from three Romanian churches have been treated. The samples were first weighed and photographed and also examined under microscope for descovering the biodeterioration factors that affected them (insects, moulds). Then they were immersed in styrene polyester resin for impregnation under pressure during 40 hours. After impregnation they were irradiated for the *in-situ* polymerisation of the resin inside the wood. Finally, the irradiated samples were again weighed and photographed and also examined under microscope for characterisation of the treated wood. The samples will be further tested in Romania to measure the consolidation effect of the polymerised resin.

The final results of the collaboration between Romanian and French research teams will be communicated in two contributions already proposed at the International Conference on Wood Science for Preservation of Cultural Heritage: Mechanical and Biological Joint Meeting of COST Action IE0601 “Wood Science for Conservation of Cultural Heritage”, and the European Society for Wood Mechanics, Braga, Portugal, 5-7 November 2008.

Regarding future collaboration between Romanian, French research teams and other European ones, a technical cooperation project supported by IAEA (International Atomic Energy Agency in Vienna, Austria) with the title: “Nuclear techniques for characterisation and preservation of cultural heritage artifacts in Europe region” is actually prepared.

During the mission it was also done a technical visit at Ionisos company in Dagneux (industrial irradiation facility). The discussions with Dr. Sophie Rouif, Research and Development Manager at Ionisos, were focused on research collaboration possibilities between our teams in the field of plastic modification through irradiation, in order to establish a consortium for the proposal of a FP7 research project.

In conclusion, the mission’s work plan has been fulfilled and the mission’s purpose has been reached. This first collaboration on disinfection and consolidation by irradiation of wooden cultural heritage objects between the Romanian and French research teams was fruitful and further collaborations in the field have already been started.