

Introduction to the use of electrochemical techniques in metal conservation

Electrochemical techniques are perfectly adapted to the surface cleaning of soft metal objects (lead covered with a terrestrial / marine crust or tarnished silver) or 3D complex objects (the treatment proceeds homogeneously on the whole surface). They make it possible the quick and efficient stabilisation of materials impregnated with active salts (chlorides from archaeological metals recovered from marine sites or metallic salts from organic materials) through their extraction. Lead objects corroded in atmospheres rich in aggressive organic acids can be consolidated and objects that cannot be fully immersed can be treated locally. More recently, these techniques have found some interesting applications in the qualitative and quantitative analysis of cultural heritage metal objects. The fact that electrochemical techniques are easily transportable and relatively cheap is another important advantage.

The course proposed will enable the participants to get an overview of the possible applications of electrochemical techniques in the conservation of metal objects. Basic theoretical knowledge will be provided in parallel to practical sessions.

Requested theoretical knowledge for the course: redox reactions, potential-pH diagrams.

The course is given by **M. Christian Degrigny**, professor at HECR Arc. After his engineering diploma in electrochemistry he received his PhD in analytical chemistry. Since he specialised in the use of electrochemistry in conservation science.

Content of the course:

Theoretical and practical sessions will follow one another (see attached programme)

Theoretical sessions

- Definition and measure of the corrosion potential (E_{corr}) of a metal object,
- Metals in solution: parameters influencing corrosion (pH and others),
- Artificial modification of the electrochemical behaviour of metal objects by an external source of current (polarisation),
- Application in conservation.

Practical sessions

- E_{corr} measurement and parameters influencing E_{corr} : application to the qualitative analysis of metal objects,
- Use of Pourbaix and modified Pourbaix diagrams,
- Introduction to the use of a potentiostat,
- Electrolytic devices and setting up of treatment parameters,
- Simulation of treatments in real conditions and monitoring of electrolytic parameters,
- Specific applications: cathodic protection, electrolytic pen, mass treatment and treatment with pulsed currents.

Target audience and cost:

Target audience: Archaeological and historic objects conservators. The course is limited to 10 participants.

Depending on the origin of the participants the course will be given in French or in English.

The cost for the week course is 1020€. This cost includes all equipment needed during the course.

Travel expenses + accommodation at La Chaux-de-Fonds / or Le Locle are supported by the participants.

Dates and venue :

Dates: **From Monday 17 to Friday 21 May, 2010**

Venue: **Haute Ecole Arc Ingénierie, Hôtel-de-Ville 7 ; CH 2400 Le Locle**

Informations et inscriptions :

Haute école de Conservation-restauration Arc

Paix 60

CH -2300 La Chaux-de-Fonds

Tél. +41 32 930 19 19

Fax +41 32 930 19 20

Email conservation-restauration@he-arc.ch

PROGRAMME

	Day 1	Day 2	Day 3	Day 4	Day 5
Morning	L1: Objectives of the course and a bit of history... L2 Basic principles - E_{corr} : Definition and measurement	Review of day 1 experiments	Review of day 2 experiments	Review of day 3 experiments	Review of day 4 experiments
		L4: Influence of pH on E_{corr} (Pourbaix diagrams) : corrosion prediction	L5: Artificial modification of the electrochemical behaviour using an external source of current (polarisation)	Pract 7: Determination of treatment parameters (cleaning of tarnished silver, consolidative reduction on lead, cleaning of iron and copper-based objects using the bubbling of hydrogen)	Pract 9: Cathodic protection and the use of sacrificial anodes
	Pract 1: Measurement of E_{corr} - Meaning of E_{corr} measurements	Pract 3: Use of Pourbaix diagrams : from theory to practise	Pract 5: Setup of electrolytic devices and choice of the treatment parameters : limitations of basic equipment		
Lunch					
Afternoon	L3: Metals in solution: parameters affecting E_{corr}	Appl 1 : Metals in solution: application to the analysis of metals, their storage and stabilisation	L6: Understanding of electrochemical reactions : use of a potentiostat	Appl 2: Use of electrolytic techniques in conservation	Pract 10: Other applications : the electrolytic pen, mass treatments, polarisation with pulsed currents
	Pract 2: Parameters affecting E_{corr}		Pract 6 : Introduction to the use of a potentiostat : voltammetric plots		
		Pract 4: The "SPAMT-Test" tool : qualitative analysis of copper-based alloys			

L: lecture, Pract: practical session and Appl: review of practical applications.

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Registration form

Family name, first name : _____

Address (road, city code and city) : _____

Telephone : _____

Email address: _____

I register for the course : Introduction to the use of electrochemical techniques in metal conservation

My payment (1020€) will be sent after receipt of the corresponding invoice.

Date : _____ Signature : _____

Registration form to send back to :

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