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EUROCORR 2014

THE EUROPEAN CORROSION CONGRESS
*"IMPROVING MATERIALS DURABILITY: FROM CULTURAL HERITAGE
TO INDUSTRIAL APPLICATIONS"*

September 8 - 12, 2014
Palazzo dei Congressi, Pisa, Italy

EUROPEAN CORROSION CONGRESS



EFC Event No. 364

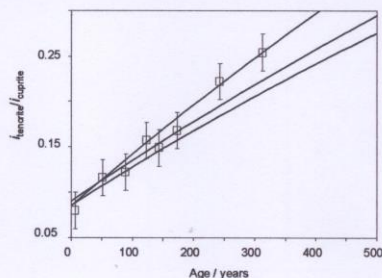
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Dating copper-based archaeological materials using the voltammetry of microparticles

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The voltammetry of microparticles, an electrochemical technique providing information on the composition of archaeological materials using an essentially non invasive analysis [1,2] was previously applied for dating lead-based materials [3,4]. It is described the application of this methodology for dating copper-based archaeological materials based on a theoretical model for long term metal corrosion [5]. Dating is based on the measurement of the voltammetric signals of cuprite and tenorite formed as a corrosion products in artifacts submitted to aging in atmospheric environments with no exigent corroding conditions. Assuming that the composition and conditions of aging can be considered as similar for all samples, and that the corrosion proceeded uniformly during the entire corrosion time, the time variation of the tenorite/cuprite ratio fits to a potential law from calibration using a set of copper-based coins (see Figure). As a result, absolute dating can be obtained.



References

- [1] Doménech, A.; Doménech, M.T.; Costa, V. *Electrochemical methods applied to archaeometry, conservation and restoration*, (Scholz, F. Edit.) Springer, Berlin-Heidelberg, 2009.
- [2] Doménech, A.; Doménech, M.T.; Pasies, T.; Bouzas, M.C. *Electroanalysis*, 2011, 23, 2803-2811.
- [3] Doménech, A.; Doménech, M.T.; Peiró, M.A. *Analytical Chemistry* 2011, 83, 5639-5644.
- [4] Doménech, A.; Doménech, M.T.; Peiró, M.A.; Martínez, I.; Barrio, J. *Journal of Solid State Electrochemistry* 2012, 16, 2349-2356.
- [5] Doménech, A.; Doménech, M.T.; Pasies, T.; Bouzas, M.C. *Electroanalysis*, 2012, 24, 1945-1955.

Scientific lectures Programme - Tuesday 9 September

12:20	O-7197	Staining of bronze sculptures, determining the causes A.R. <u>Moreira</u> , IPT Institute for Technological Research, Sao Paulo/BR; K. Barbosa, MASP Museu de Arte de São Paulo/BR; N.L. Almeida, Z. Panossian, IPT Institute for Technological Research, Sao Paulo/BR
12:40 Lunch		
Corrosion of Archaeological and Historical Artefacts Room E		
Chairs D. Neff		
14:00	O-7382	The role of microstructure on initial corrosion and metal release of Cu-Zn alloys in a chloride-containing laboratory atmosphere X. Zhang, I. Odnevall Wallinder, C. <u>Leygraf</u> , KTH Royal Institute of Technology, Stockholm/S
14:20	O-7192	Atmospheric corrosion of fire gilded bronze: accelerated ageing in runoff conditions C. <u>Chiavari</u> , C. Martini, E. Bernardi, S. Raffo, University of Bologna/I; A. Balbo, M. Abbottoni, University of Ferrara/I; M.C. Bignozzi, University of Bologna/I; C. Monticelli, University of Ferrara/I
14:40	O-7311	Dating copper-based archaeological materials using the voltammetry of microparticles A. <u>Doménech</u> , University of Valencia, Burjassot/E; S. Capelo, University of Évora/P; T. Doménech, Institute of Restoration of Cultural Heritage, Valencia/E
15:00	O-7425	Prediction of long-term corrosion rate of copper alloy objects K. Kreislova, SVUOM Ltd., Prague/CZ; H. Geiplova, UTAM, Telc/CZ
15:20	O-7787	A multi-technique approach for characterizing patina formed on the surface of brass used for musical instrument of the XIX century F. Cocco, M. Fantauzzi, Università di Cagliari/I; G. Peschke, B. <u>Elsener</u> , ETH Zurich/CH; A. Rossi, Università di Cagliari/I
15:40 Coffee break		
Corrosion of Archaeological and Historical Artefacts Room E		
Chairs D. Neff		
16:10	O-7186	In situ study of long term atmospheric corrosion of iron by μRaman spectroscopy M. <u>Bouchar</u> , D. Neff, CEA, Gif sur Yvette/F; J.P. Gallien, CEA and CNRS, Gif sur Yvette/F; P. Dillmann, CNRS, Gif sur Yvette/F
16:30	O-7474	An integrated EIS-Raman approach to study the corrosion mechanism of iron artefacts S. <u>Grassini</u> , Politecnico di Torino/I; M. Bouchar, CNRS, Gif-sur-Yvette/F; E. Angelini, M. Parvis, Politecnico di Torino/I; D. Neff, P. Dillmann, CNRS, Gif-sur-Yvette/F

Programme-at-a-glance

Registration				
Coffee break				
Room E	Room 4	Room 2	Room 5	Room 3
Archaeological and Historical Artefacts	Corrosion of Steel in Concrete	WS B: Corrosion Reliability of Electronic Devices	Microbial Corrosion	WS K: Valuable building and urban decoration
<i>D. Neff</i>	<i>M. Raupach / C. Helm</i>	<i>R. Ambat / H. Schweigart</i>	<i>P. Cristiani / R. Basseguy</i>	<i>P.L. Bonora</i>
7139 M. Kouril	7200 R. Melchers	7822 R. Ambat	Keynote 7848 P. Refait	7835 F. Ciardelli
7190 C. Chiavari	7261 C. Monticelli	7819 H. Schweigart		7828 F. Meneghelli
7464 B. Salvadori	7437 E. Volpi	7818 M. Nowotnick	7623 F. Mercier-Bion	7807 G. Di Tanna
7259 A. Balbo	7551 M.C. Bignozzi	7447 V. Verdingovas	7794 M. Carvalho	7816 P.L. Bonora
7197 A.R. Moreira	7550 M. Kosalla	7082 H. Conseil	7353 A. Spark	7812 A. Locaspi
Lunch				
Archaeological and Historical Artefacts	Corrosion of Steel in Concrete	WS B: Corrosion Reliability of Electronic Devices	Microbial Corrosion	WS K: Valuable building and urban decoration
<i>D. Neff</i>	<i>M. Raupach / C. Helm</i>	<i>R. Ambat / H. Schweigart</i>	<i>P. Cristiani / R. Basseguy</i>	<i>P.L. Bonora</i>
7382 C. Leygraf	7060 U. Angst	7495 K. Piotrowska	7384 I. Rouvre	7450 M.P. Pedferri
7192 C. Chiavari	7260 F. Pargar	7227 J. Cetier	7077 P. Beese-Vasbender	7849 A. Colombo
7311 A. Domenech	7553 B. Tribollet	7225 J. Cetier	7703 A. Allion	7782 T. Ishizaki
7425 K. Kreislova	7624 M. Gastaldi	7436 M.S. Jellesen	7084 A. Lotfollahi Yaghin	
7787 B. Elsener		7521 K.A. Schmidt	7533 M. Grattieri	
Coffee break				
Archaeological and Historical Artefacts	Corrosion of Steel in Concrete	WS B: Corrosion Reliability of Electronic Devices	Microbial Corrosion	
<i>D. Neff</i>	<i>M. Raupach / C. Helm</i>	<i>R. Ambat / H. Schweigart</i>	<i>P. Cristiani / R. Basseguy</i>	
7186 M. Bouchar	7207 G. Ebell	7203 R. Minamitani	7199 R. Melchers	
7474 S. Grassini	7546 T. Bellezze	7824 L. Müller	7229 T.L. Skovhus	
7594 S. Grousset	7314 I. Pepenar	7236 M.A. Ashworth	7613 D. Fischer	
7136 C. Remazelles	WP 11 business meeting	7403 C.J. Stuttle	7846 Y. Fei	WP 22 business meeting
7651 H. De Melo		7823 J.B. Jacobsen	7334 Z. Song	
EFC General Assembly			7683 H. Ge	