doi:10.2533/chimia.2008.530 CHIMIA **2008**, *62*, No. 6

Highlights of Analytical Chemistry in Switzerland

In situ Element-Specific and Time-Resolved Investigation of Micro-Corrosion Processes

Nadzeya Homazava*[ab], Andrea Ulrich[a], and Urs Krähenbühl[b]

*Correspondence: N. Homazava[a], Tel.: + 41 44 823 43 54, Fax: +41 44 823 40 41, E-mail: nadzeya.homazava@empa.ch

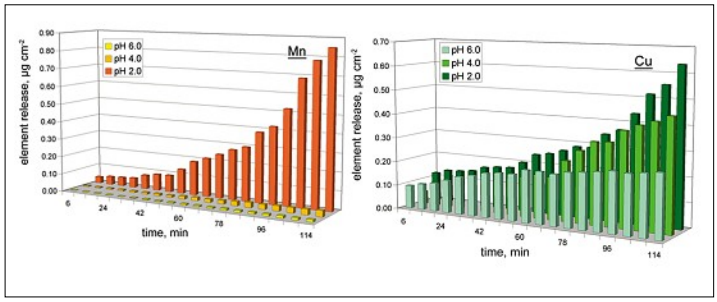
[a]EMPA, Swiss Federal Laboratories for Materials Testing and Research, Ueberlandstrasse 129, CH-8600 Dübendorf

[b]University of Bern, Department of Chemistry and Biochemistry, Freiestrasse 3, CH-3012 Bern

Keywords: Corrosion · Element-specific, time-resolved analysis · Flow injection analysis · Inductively coupled plasma mass spectrometry · Localized corrosion

Detailed information on corrosion processes provides the key to effective prediction and minimization of corrosion damages. The initiation stage of material decomposition plays a special role, since the corrosion often starts at the weakest locations such as surface defects, grain boundaries, segregations or inclusions. However, surface analysis or electrochemical methods commonly used in corrosion research (*e.g.* electrochemical methods, SEM-EDX, *etc.*) cannot present local element-specific and online *in situ* information at the same time.

Corrosion is an economic issue since it destroys material goods



Time-resolved dissolution behavior of Mn and Cu in AA 6111 using 0.1 M NaCl corrosive media at different pHs

As a solution a technique for localized element-specific investigations of corrosion processes has been developed. The technique is based on an adjustable online microflow-capillary set-up especially designed for local *in situ* experiments at trace and ultratrace concentration levels. The capillary is online connected *via* flow injection (FI) analysis system to an inductively coupled plasma mass spectrometry ICP-MS. FI allows a transient sample introduction, whereas ICP-MS is designed for highly sensitive multi-element quantification.

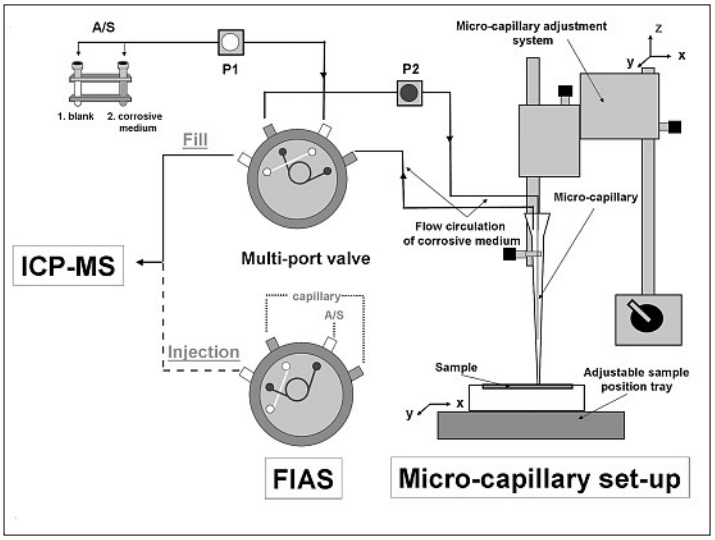
The efficiency of the developed technique could be proved by corrosion susceptibility analysis of a commercial aluminum alloy. The influence of various factors such as exposure time or pH value of corrosive media on the element-specific dissolution rates was studied in alloy AA 6111. This information is especially valuable for alloying elements present in the alloy in sub-percent quantities, which could also be detected in very low concentrations in the solution as *e.g.* Cu and Mn. The element-specific investigation of corrosion behavior of AA 6111 revealed a relatively high release of the secondary alloying element Cu in the studied pH range. **New insights into the behavior of copper during the corrosion process, not fully understood so far, can be obtained with the newly developed *in situ* experiments.**

Received: April 24, 2008

References

N. Homazava, A. Ulrich, M. Trottmann, U. Krähenbühl, *J. Anal. Atom. Spectrom.* **2007**, *9*, 1122.

N. Homazava, A. Ulrich, U. Krähenbühl, *Spectrochim. Acta, Part B,* submitted.



Principle of the novel microcapillary FI-ICP-MS set-up

Can you show us your analytical highlight?
Please contact: Dr. Veronika R. Meyer, EMPA St.Gallen, Lerchenfeldstrasse 5, 9014 St.Gallen
Phone: 071 274 77 87, Fax: 071 274 77 88, Mail to: veronika.meyer@empa.ch