

Supplementary Information

Uranium Hydroxide/Oxide Deposits on Uranyl Reduction

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Abstract: We clarified the chemical reaction of deposits following the reduction of uranyl ion ($U^{VI}O_2^{2+}$) from the results of electrochemical quartz crystal microbalance, impedance spectra and X-ray absorption fine structure measurements. We propose the following deposition mechanism: 1) U^{IV} is formed by the disproportionation of U^V . 2) U^{IV} forms U^{IV} hydroxide deposits, and 3) finally, the hydroxide deposits change to U^{IV} oxide, generally having a larger electrical resistance than the former.

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Results

Table S1 The results of fitting by the equivalent circuit of the electrode covered by 9.6 nmol of U deposits.

	4 min	20 min	50 min	80 min
R_{sol} / Ω	$(1.97 \pm 0.08) \times 10$	$(2.11 \pm 0.03) \times 10$	$(2.12 \pm 0.03) \times 10$	$(2.11 \pm 0.03) \times 10$
R_{dep} / Ω	$(1.3 \pm 0.2) \times 10$	$(1.86 \pm 0.07) \times 10$	$(2.00 \pm 0.08) \times 10$	$(2.08 \pm 0.08) \times 10$
$p_{CPE,dep}$	0.47 ± 0.08	0.66 ± 0.03	0.67 ± 0.03	0.67 ± 0.03
$T_{CPE,dep} / Fs^{p-1}$	$(10 \pm 6) \times 10^{-4}$	$(1.3 \pm 0.3) \times 10^{-4}$	$(1.0 \pm 0.3) \times 10^{-4}$	$(9 \pm 3) \times 10^{-5}$
R_{ct} / Ω	$(7.6 \pm 0.3) \times 10^4$	$(1.03 \pm 0.03) \times 10^5$	$(1.9 \pm 0.1) \times 10^5$	$(2.05 \pm 0.01) \times 10^5$
$p_{CPE,dl}$	0.993 ± 0.003	0.939 ± 0.002	0.928 ± 0.002	0.924 ± 0.002
$T_{CPE,dl} / Fs^{p-1}$	$(2.54 \pm 0.02) \times 10^{-4}$	$(2.26 \pm 0.01) \times 10^{-4}$	$(2.16 \pm 0.01) \times 10^{-4}$	$(2.12 \pm 0.01) \times 10^{-4}$

Table S2 The results of fitting by the equivalent circuit of the electrode covered by 21.1 nmol of U deposits.

	4 min	20 min	50 min	80 min
R_{sol} / Ω	$(1.97 \pm 0.02) \times 10$	$(1.99 \pm 0.09) \times 10$	$(1.98 \pm 0.01) \times 10$	$(1.98 \pm 0.01) \times 10$
R_{dep} / Ω	$(1.42 \pm 0.04) \times 10$	$(2.13 \pm 0.02) \times 10$	$(2.66 \pm 0.04) \times 10$	$(2.88 \pm 0.04) \times 10$
$p_{CPE,dep}$	0.47 ± 0.02	0.514 ± 0.007	0.5235 ± 0.008	0.5210 ± 0.008
$T_{CPE,dep} / Fs^{p-1}$	$(1.1 \pm 0.2) \times 10^{-3}$	$(6.3 \pm 0.4) \times 10^{-4}$	$(5.1 \pm 0.4) \times 10^{-4}$	$(5.1 \pm 0.3) \times 10^{-4}$
R_{ct} / Ω	$(1.5 \pm 0.5) \times 10^6$	$(1.23 \pm 0.02) \times 10^5$	$(1.22 \pm 0.03) \times 10^5$	$(1.18 \pm 0.02) \times 10^5$
$p_{CPE,dl}$	0.9895 ± 0.0009	0.9659 ± 0.0008	0.9498 ± 0.0008	0.9468 ± 0.0008
$T_{CPE,dl} / Fs^{p-1}$	$(5.70 \pm 0.01) \times 10^{-4}$	$(4.930 \pm 0.006) \times 10^{-4}$	$(4.737 \pm 0.008) \times 10^{-4}$	$(4.594 \pm 0.008) \times 10^{-4}$