Self-assembled, nanostructured coatings for water oxidation by alternating deposition of Cu-branched peptide electrocatalysts and polyelectrolytes.

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Streszczenie

This work demonstrates the heterogenization of homogeneous water oxidation electrocatalysts in surface coatings produced by combining the substances with a suitable polyelectrolyte. The electrocatalysts *i.e.* Cu(II)-branched peptide complexes involving a 2,3-L-diaminopropionic acid junction unit are heterogenized by building composite layers on indium-tin-oxide (ITO) electrode surface. Alternating deposition of the peptide complexes and poly(L-lysine) or poly(allylamine hydrochloride) were carried out in the presence of phosphate in a pH range of 7.5–10.5. Discussion of the results is divided to (1) characteristics of composite layer buildup and (2) electrocatalytic water oxidation and accompanying changes of these layers. For (1), optical waveguide lightmode spectroscopy (OWLS) has been applied to reveal the layer-by-layer formation of a Cu-ligand/polyelectrolyte/phosphate coating. The fabricated structures had a nanoporous topography (atomic force microscopy). As for (2), electrochemistry employing coated ITO substrates indicated improved water oxidation electrocatalysis *vs.* neat ITO and dependence of this improvement on the presence or absence of a histidine ligand in the deposited Cu(II)-complexes equally, as observed in homogeneous systems. Electrochemical OWLS revealed changes in the coatings *in operando*, upon alternating positive–zero–positive*etc.* polarization: after some initial loss of the coating mass steady-state electrolysis was sustained by a compact and stable layer. According to X-ray photoelectron spectroscopy Cu remains in an N-donor ligand environment after electrolysis.

Adres publiczny

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https://www.rsc.org/