Formation of bioinorganic complexes by the corrosive adsorption of nickel clusters by chiral amino acids

Chris J Baddeley

EaStCHEM School of Chemistry, University of St Andrews, St Andrews, Fife, KY16 9ST

Amino acids are key building blocks in the formation of peptide linkages and proteins in biological organisms. For reasons not yet clearly understood, amino acids in living organisms on Earth exist exclusively in the (*S*)- enantiomeric form. One of the most important consequences of biomolecular homochirality is that humans are extremely sensitive to the chirality of organic molecules such as pharmaceutical compounds. Consequently, many pharmaceutical targets must be created as pure enantiomers. The development of heterogeneous catalysts capable of producing large quantities of enantiomerically pure chemicals is an important industrial challenge. One approach which has attracted considerable attention is the use of Ni surfaces modified by the adsorption of amino acids in enantioselective catalysis.[1]

A fascinating feature of many amino acids is their ability to corrode and restructure metal surfaces. For example, the adsorption of lysine onto Cu(001) resulted in the formation of chiral Cu facets.[2] From the viewpoint of enantioselective catalysis, the formation of chiral arrangements of metal atoms or chiral organometallic complexes following corrosion by a chiral amino acid could provide active sites for enantioselective surface chemistry. Scanning Tunneling Microscopy (STM); Synchrotron X-ray Photoelectron Spectroscopy (XPS), High Resolution Electron Energy Loss Spectroscopy (HREELS) and DFT calculations have been carried out monitoring the adsorption of simple amino acids (glutamic acid, lysine and proline) on Au(111) surfaces templated by 2D Ni nanoclusters grown at the elbows of the Au herringbone reconstruction.[3] In each case, the amino acids are shown to corrosively oxidise the Ni clusters forming a number of ordered molecular arrangements. The composition and structure of these arrangements are identified and discussed. In addition, the interaction of the pro-chiral reagent, methylacetoacetate, with chirally modified metal surfaces is investigated.

References:

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Email corresponding author: cjb14@st-andrews.ac.uk