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Intermediate oxidation states of technetium in concentrated sulfuric acid solutions

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Abstract

The electrochemical reduction of pertechnetate ions (TcO_4^-) and properties of such formed reduced Tc containing species (ions and molecules) have been studied in strongly acidic media (4–12M aqueous H_2SO_4) using electrochemical (cyclic voltammetry (CV); chronoamperometry (CA), chronopotentiometry (CP)) and spectroelectrochemical (UV-VIS OTTLE and Au-SERS) techniques. The results show generation of Tc(V) containing species in the first steps of the pertechnetate electroreduction. The experiments carried out in 6, 8 and 10M H_2SO_4 have shown that an increase in the acid concentration shifts the Tc(VII) electroreduction wave towards positive potential values. Additional Au-SERS experiments indicate generation of Tc species with intermediate oxidation states (V) characterised by a band at 792 cm^{-1} that are distinguishable from TcO_2 or polymeric Tc(IV) forms. Application of derivative pulse techniques allows determination of pertechnetates in strongly acidic solutions at a level of 10^{-6} mol/dm^3 even in the presence of impurities, such as Fe^{3+} and Cl^- , with concentrations comparable or greater than pertechnetates.

Keywords: technetium, spectroelectrochemistry,

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