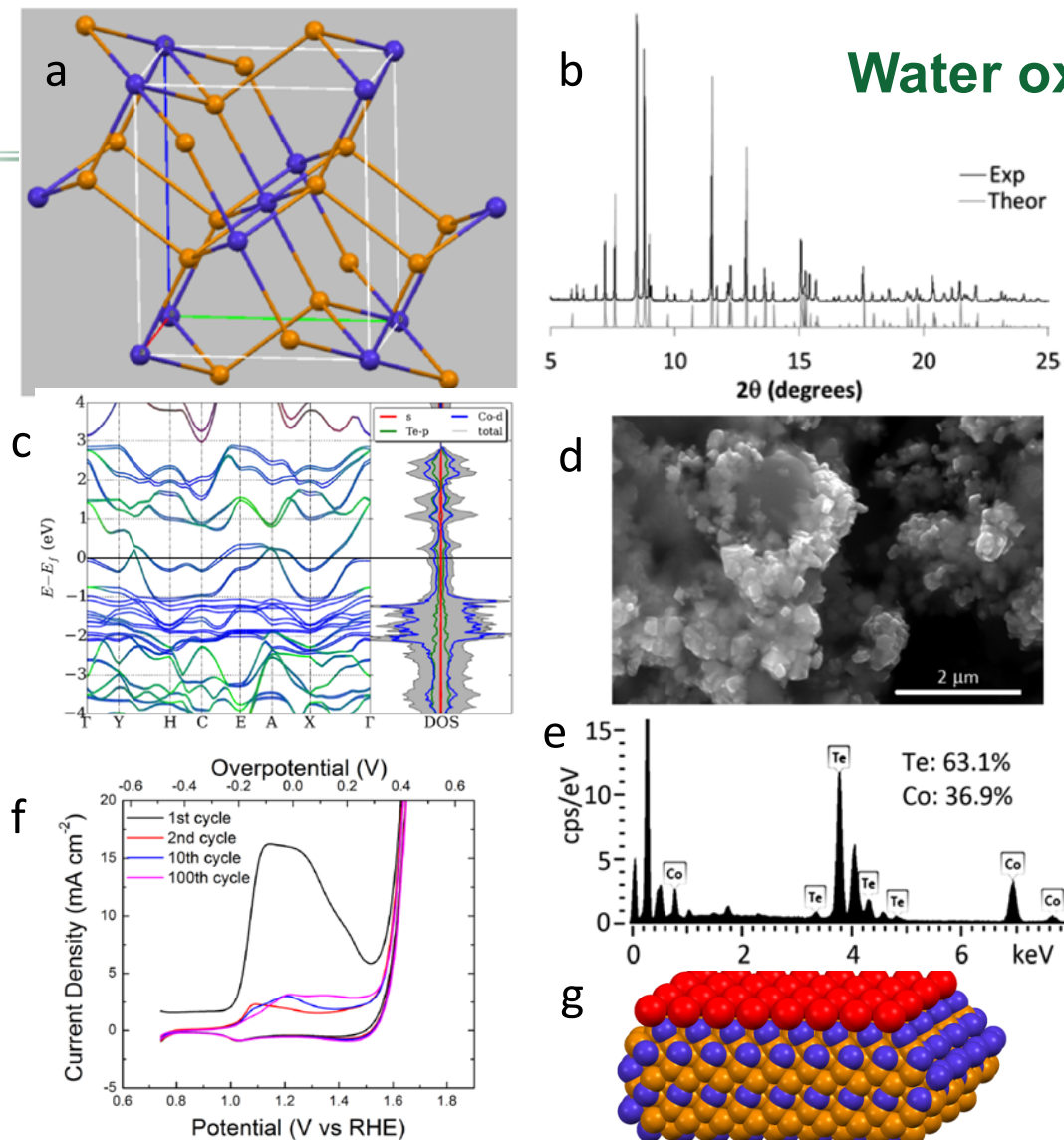


Water oxidation catalysis at CoTe_2



a) Unit cell of mattagamite. **b)** experimental and theoretical XRD. **c)** Density of states from DFT. **d)** SEM of mattagamite. **e)** EDX of mattagamite. **f)** electrochemical LSV showing surface activation and catalytic wave. **g)** proposed active oxide surface on conductive CoTe_2 substrate.

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Work performed at Temple University

Scientific Achievement

Synthesis and theoretical investigation of active Co-O-Te-based water oxidation catalytic layer at the surface of a bulk, synthetic phase of electrically conductive CoTe_2 . The inexpensive material is competitive with precious-metal catalysts.

Significance and Impact

Heavier chalcogenides (S, Se, Te) have not been as extensively explored as have oxides for water oxidation catalysis due ease of oxidative decomposition to form oxyanions. The cooperative theoretical and experimental approaches permit detailed investigation of this catalyst's function.

Research Details

Mattagamite CoTe_2 (a) is prepared by reduction of TeO_3^{2-} by hydrazine in the presence of Co^{2+} . The material is identified by XRD (b), EDX (e), and ICP-OES. Electrochemical measurement by LSV shows a surface activation on the initial sweep at 1.2 V. vs. RHE, followed by a catalytic wave for water oxidation at 830 mV @ 10 mA cm^{-2} (b). DFT (c) and diffuse reflectance absorption spectroscopy demonstrate electronic conduction to a surface catalytic Co-O-Te later (g) evidenced by XPS, ICP-OES, and electrochemistry.



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