Lanthanide Catalyzed Oxygen Reduction

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INTRODUCTION

● Oxygen reduction reactions (ORR) are of interest in research because this type of reaction is useful in fuel cells that can produce cleaner sources of energy.

● However, this type of reaction alone is not efficient, but with exploration of the salts found in the lanthanide family, we may be able to catalyze these reactions leading to increased efficiency.

● Additionally, lanthanide salts can be found in radioactive waste produced by nuclear power plants; lanthanide isotopes are produced during the fission of U235 and with a half-life of less than one day, decay to non-radioactive lanthanides that can be then re-used versus other nuclear waste that is left underground to decay for decades.

● Other uses for lanthanides in radioactive waste have been found, but are specific to which element they utilize and the separation of the different isotopes found in the waste has proven to be very difficult and costly, lanthanide catalyzed reactions however, are not selective and therefore will be able to best utilize the nuclear waste.

● Use of these otherwise expensive rare earth metals found in nuclear waste will allow us to explore how they can be used to catalyze reactions in electrochemical cells, use waste as a valuable resource and forge toward cleaner, renewable energy.

METHODS

BENCH TOP ELECTROCHEMICAL CELLS

Built with platinum-mesh counter electrode, Ag/Ag quasireference electrode and platinum working electrode in 1M Ytterbium(III) Trifluoromethanesulfonate (Yb(CF3SO3)3) and tetraethylammonium trifluoromethane (TBAF4) in acetonitrile electrolyte solution.

NAFION® COATING

Platinum working electrode is coated with a thin film of Nafion® and allowed to dry for 24 hours before being placed in solution.

GRAPHICAL REPRESENTATION

Any type of reduction reaction is driven by the movement of electrons, it is easiest to observe and analyze this through graphical representation, the method we are using is cyclic voltammetry performed with a potentiostat.

REFERENCE


