

Electrochemistry of the Polyhydroboranes

Our research is aimed at addressing the DOE 2010 hydrogen storage targets by conducting fundamental electrochemical research on the complex polyhedral boranes (polyboranes). We are focused on exploring and defining the fundamental electrochemistry of polyboranes and polyborane anion salts. As an additional course of action, we will explore the feasibility of developing a reversible hydrogen storage technology based on the polyborane system.

Our work is being accomplished in close cooperation with scientists from Intematix, Inc.; Pacific Northwest National Laboratory; Los Alamos National Lab; and The University of California at Los Angeles. The initial activities investigating complex polyboranes are concentrated on the identification of electrolysis reaction products and definition of reaction mechanisms. Various techniques will be employed in this work, including electrochemical impedance spectroscopy, cyclic voltammetry (CV), and rotating disk and rotating ring/disk voltammetry.

Very little work has been done on this subject and virtually no open literature can be found after the 1970s. Between the 1950s and the 1970s, much of the work done was to determine the identities of various polyboranes that were produced by chemical redox reactions. It was discovered that the polyborane cage molecules combine to form larger molecules that keep the individual cages intact. For instance, two $B_{12}H_{12}^{2-}$ dianions can be chemically converted to a single $B_{24}H_{23}^{3-}$ polyanion, and many other conversions exist. We have found that several polyboranes exhibit electrochemical behavior and it is our goal to determine the reaction mechanism for the transformation from one form to another, however we must note that this study will not be exhaustive since there are nearly 50,000 polyboranes known to exist.

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