MATERIAL SAFETY DATA SHEET

Section I. Chemical Product and Company Identification

Product Name	Anode Supported Bilayer/Cell
Product Code	AEB, ASC
CAS Number	Mixture
Supplier's Name	Fuel Cell Store
Address	1902 Pinon Drive, Unit B College Station, TX, USA 77845
Information Telephone Number	614-842-6606
Date Prepared	December 15, 2014

Section II. Composition / Information on Ingredients

Component	CAS #	% (Optional)
Lanthanum oxide	1312-81-8	
Iron oxide	1309-37-1	
Strontium oxide	1314-11-0	
Cerium (IV) oxide	1306-38-3	
Gadolinium oxide	12064-62-9	
Nickel (II) oxide	1313-99-1	
Zirconium Oxide	1314-23-4	
Yttrium Oxide	1314-36-6	
• Additional information: Zirconium is routinely found with a low level of hafnium since separation of the two elements is difficult.		

Section III. Hazards Identification

- Hazard description: **T** Toxic, Irritant, Harmful
- Information pertaining to particular dangers for man and environment
  Irritating to eyes, respiratory system and skin.
  Harmful by inhalation, in contact with skin and if swallowed.
  R 49 May cause cancer by inhalation.
  R 43 May cause sensitization by skin contact.

Section IV. First Aid Measures

- **After inhalation**
  Supply fresh air. If required, provide artificial respiration. Keep patient warm.
  Seek immediate medical advice.
- **After skin contact**
  Immediately wash with water and soap and rinse thoroughly. Remove affected clothing.
  Seek immediate medical advice.
- **After eye contact**
  Rinse opened eye for several minutes under running water. Then consult a doctor.
- **After swallowing**
  Seek immediate medical advice.

Section V. Fire Fighting Measures

- **Suitable extinguishing agents**
  Product is not flammable. Use fire-fighting measures that suit the surrounding fire.
- **Protective equipment:**
  Wear self-contained respirator.
  Wear fully protective impervious suit.

Section VI. Accidental Release Measures

- **Suitable extinguishing agents** Extinguishing powder. Avoid use of water.
- **Special hazards caused by the material, its products of combustion or resulting gases:**
  Wear self-contained respirator.
  Wear fully protective impervious suit.

Section VII. Handling and Storage

- **Handling**
- **Information for safe handling:**
  Keep container tightly sealed.
  Store in cool, dry place in tightly closed containers.
  Ensure good ventilation at the workplace.
- **Information about protection against explosions and fires:**
  The product is not flammable

Storage

- **Requirements to be met by storerooms and receptacles:**
  No special requirements.
- **Information about storage in one common storage facility:**
  Do not store together with oxidizing and acidic materials.
  Store away from water/moisture.
- **Further information about storage conditions:**
  This product is hygroscopic.
  Keep container tightly sealed.
  Store in cool, dry conditions in well sealed containers.

Section VIII. Exposure Controls and Personal Protection

- **Additional information about design of technical systems:**
  Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.
- **Components with limit values that require monitoring at the workplace:**

Component	Limit Values (mg/m^3)	
	NIOSH REL	OSHA PEL
Nickel and inorganic compounds as Ni	0.015	1.0
Iron oxide dust and fume as Fe	5.0	10.0
Zirconium Oxide	5.0	5.0
Yittrium Oxide	1.0	1.0

- **Additional information:** No data
- **Personal protective equipment**
- **General protective and hygienic measures**
  The usual precautionary measures for handling chemicals should be followed.
  Keep away from foodstuffs, beverages and feed.
  Remove all soiled and contaminated clothing immediately.
  Wash hands before breaks and at the end of work.
  Avoid contact with the eyes and skin.
- **Breathing equipment:**
  Use suitable respirator when high concentrations are present.
- **Protection of hands:** Impervious gloves
- **Eye protection:**
  Safety glasses
  Tightly sealed goggles
  Full face protection
- **Body protection:** Protective work clothing.

Section IX. Physical and Chemical Properties

- **Form:** planar solid
- **Color:** Not determined

- **Odor:** Not determined
- **Melting point/Melting range:** Not determined
- **Boiling point/Boiling range:** Not determined
- **Sublimation temperature / start:** Not determined
- **Flash point:** Not applicable
- **Flammability (solid, gaseous)** Product is not flammable.
- **Ignition temperature:** Not determined
- **Decomposition temperature:** Not determined
- **Danger of explosion:**
  Product does not present an explosion hazard.
- **Explosion limits:**
- **Lower:** Not determined
- **Upper:** Not determined
- **Vapor pressure:** Not determined
- **Density:** Not determined
- **Solubility in / Miscibility with**
- **Water:** Insoluble

Section X. Stability and Reactivity

- **Thermal decomposition / conditions to be avoided:**
  Decomposition will not occur if used and stored according to specifications.
- **Materials to be avoided:**
  Water/moisture
  Acids
  Oxidizing agents
  Carbon dioxide
- **Dangerous reactions** No dangerous reactions known
- **Dangerous products of decomposition:** Metal oxide fume

Section XI. Toxicological Information

- **Acute toxicity:**
  LD/Lc50 values that are relevant for classification:
  Cerium (IV) oxide (CAS# 1306-38-3), 100%
  Oral: LD50: >5000 mg/kg (rat)
  Gadolinium oxide (CAS# 12064-62-9), 100%
  Oral: LD50: 5000 mg/kg (rat)
- **Primary irritant effect:**
- **on the skin:** Irritant to skin and mucous membranes, may be corrosive
- **on the eye:** mild: 100 mg (rbt)
- **Sensitization:** No sensitizing effects known.
- **Subacute to chronic toxicity:**
  Lanthanons can cause delayed blood clotting leading to hemorrhages. Exposure may also lead to sensitivity to heat, itching, increased awareness of odor and taste, and liver damage.
  Chronic exposure to manganese may cause impairment to the central nervous system. Symptoms include sluggishness, sleepiness, muscle weakness, loss of facial muscle control, edema, emotional disturbances, spastic gait and falling. Chronic manganese poisoning may develop after as little as three months of heavy exposure but usually cases develop after one to three years of exposure.
  Strontium has a low order of toxicity. High doses have caused changes in blood clotting factors, adrenal function and liver function.
  Corrosive materials (such as SrO) are acutely destructive to the respiratory tract, eyes, skin and digestive tract. Eye contact may result in permanent damage and complete vision loss. Inhalation may result in respiratory effects such as inflammation, edema, and chemical pneumonitis. May cause coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting. Ingestion may cause damage to the mouth, throat and esophagus. May cause skin burns or irritation depending on the severity of the exposure.

Nickel and nickel compounds may cause a form of dermatitis known as nickel itch. They may also cause intestinal disorders, convulsions and asphyxia. Airborne nickel contaminated dusts are regarded as carcinogenic to the respiratory tract.
Cerium salts increase the blood coagulation rate. Exposure to cerium salts may increase sensitivity to heat, itching and skin lesions. Large doses to experimental animals have caused writhing, ataxia, labored respiration, sedation, hypotension and death by cardiovascular collapse.
Iron compounds may cause vomiting, diarrhea, pink urine, black stool, and liver damage. May cause damage to the kidneys. Irritating to the respiratory tract, they may cause pulmonary fibrosis if dusts are inhaled.
Lanthanons can cause delayed blood clotting leading to hemorrhages. Exposure may also lead to sensitivity to heat, itching, increased awareness of odor and taste, and liver damage.
Inhalation of zirconium compounds may cause pulmonary granulomas. Scandium has a low order of toxicity. As with calcium, the toxicity is generally a function of the anion.
Rare earth compounds may cause delayed blood clotting leading to hemorrhages. Exposure may also lead to sensitivity to heat, itching, increased awareness of odor and taste, and liver damage.

- **Additional toxicological information:**
  Danger through skin absorption.
  Swallowing will lead to a strong corrosive effect on mouth and throat and to the danger of perforation of esophagus and stomach.
  Carcinogenicity classification information for ***Nickel Oxide***:
  IARC-1: Carcinogenic to humans: sufficient evidence of carcinogenicity.
  NTP-2: Reasonably anticipated to be a carcinogen: limited evidence from studies in humans or sufficient evidence from studies in experimental animals.
  ACGIH A1: Confirmed human carcinogen: Agent is carcinogenic to humans based on epidemiological studies of, or convincing clinical evidence in, exposed humans.
  The Registry of Toxic Effects of Chemical Substances (RTECS) contains tumorigenic and/or carcinogenic and/or neoplastic data for components in this product.

Section XII. Environmental Information

- **General notes:**
  Do not allow material to be released to the environment without proper governmental permits.

Section XIII. Disposal Information

- **Product:**
- **Recommendation**
  Consult state, local or national regulations for proper disposal.
- **Uncleaned packagings:**
- **Recommendation:**
  Disposal must be made according to official regulations.

Section XIV. Transportation Information

- Not a hazardous material for transportation.
- **DOT regulations:**
  Hazard class: None
- **Land transport ADR/RID (cross-border)**
  ADR/RID class: None
- **Maritime transport IMDG:**
  IMDG Class: None
- **Air transport ICAO-TI and IATA-DGR:**
  ICAO/IATA Class: None
- **Transport/Additional information:**
  Not dangerous according to the above specifications.

Section XV. Regulatory Information

- Product related hazard information: observe the general safety regulations when handling chemicals.
  Hazard symbols**: T** Toxic
  Risk phrases:
  49 May cause cancer by inhalation.

43 May cause sensitization by skin contact.
Safety phrases:
53 Avoid exposure - obtain special instructions before use.
45 In case of accident or if you feel unwell, seek medical advice immediately.

- National regulations
  All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical Substance Inventory.
  This product contains a chemical known to the state of California to cause cancer or reproductive toxicity.
- Information about limitation of use:
  For use only by technically qualified individuals.
  This product contains nickel and is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right to Know act of 1986 and 40CFR372.
  This product contains manganese and is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right to Know Act of 1986 and 40CFR372.

Section XVI. Other Information

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

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