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HIGH-TEMPERATURE ELECTROCHEMICAL-SENSING ELECTRODE

HARDWARE, CIRCUITS, & SENSORS

Electrode used to make electrochemical measurements in molten salts at high temperatures for process monitoring of nuclear material.

TECHNOLOGY TYPE

Chemical Sensors
Voltammetry

STAGE OF DEVELOPMENT

- Prototypes constructed, tested, and reduced to practice using one type of molten salt.

- Ongoing research to test with other molten salts.

IP PROTECTION

U.S. Utility Patent Pending

Fixed Area Electrode for
Electrochemical Analysis of
High Temperature
US20180080899A1

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Reference Number: U-6203

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TECHNOLOGY SUMMARY

Voltammetry offers a technique to measure the concentration of ions in high-temperature molten salts, which are used in nuclear fuel and the recycling of rare-earth metals. Accurate high-temperature electrochemical measurements, however, are difficult to obtain due to interactions between the electrode and other elements as well as difficulty determining the surface area of the working electrode.

A newly developed fused glass electrode contains a fixed area metal rod. This enables accurate determination of area-dependent electrochemical measurements such as cyclic voltammetry. This fixes the surface area of the interface between the electrode and the electrolyte to eliminate uncertainty regarding the surface area. The electrode can also detect impurities, monitor ions of interest, and provide feedback for process control and optimization in high-temperature molten salts.

FEATURES AND BENEFITS

- Increases stability in high-temperature and corrosive fluids.
- Eliminates surface area uncertainty, improving quantitative analyses.
- Allows sensor to be fully emerged in a variety of liquid compositions.
- Demonstrates potential in industrial electrolysis and nuclear reactors.

RECENT PUBLICATIONS

Rappleye, D., Teaford, K., Simpson, M.F. (2016). Investigation of the effects of uranium(III)-chloride concentration on voltammetry in molten LiCl-KCl eutectic with a glass sealed tungsten electrode. *Electrochimica Acta*. 219: 721-733. doi: [10.1016/j.electacta.2016.10.075](https://doi.org/10.1016/j.electacta.2016.10.075)

INVENTOR PROFILE

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Kevin Teaford, Scientific Glassblower - Chemistry

DATE UPDATED: 7/25/2019