ANL/EVS-C1200701

Advanced Borobond™ Shields for Nuclear Materials Containment and Borobond™ Immobilization of Volatile Fission Products

Environmental Science Division

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prepared by
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Argonne NATIONAL LABORATORY

Non Proprietary

Final CRADA Report

Date: May 19, 2016

CRADA Number: C1200701

CRADA Title: Advanced Borobond™ Shields for Nuclear Materials Containment and Borobond™ Immobilization of Volatile Fission Products

CRADA Start/End Date: 08/29/2012 to 08/28/2014

Argonne Dollars: 210K

Participant Dollars: 770K

Argonne PI: Arun S. Wagh

Participant(s):

Boron Products, LLC., 770K
Name Participant Dollars

Ceradyne, Inc., 3250 S. 614 Road, Quapaw, OK 74363.
Complete Address

Name Participant Dollars

Complete Address

Name Participant Dollars

Complete Address

DOE Program Manager: Regina Carter, GIPP

Summary of Major Accomplishments:

Borobond is a company-proprietary material developed by the CRADA partner in collaboration with Argonne, and is based on Argonne's Ceramicrete technology. It is being used by DOE for nuclear materials safe storage, and Boron Products, LLC is the manufacturer and supplier of Borobond.

The major objective of this project was to produce a more versatile composition of

Summary of Major Accomplishments:

this material and find new applications, so that the Participant can seek new markets. Major target applications were:

1. Use the new version for nuclear radiation shields, such as in dry storage casks
2. Use it in immobilization of most difficult waste streams, such as Hanford K-Basin waste
3. Use it for soluble and volatile fission products, such as Cs, Tc, Sr, and I.
4. Develop thick coatings for corrosion and fire protection applications in nuclear facilities.

All the four objectives were met with results satisfactory to the Participant. Results showed that the results of new compositions performed better than any current products in the market. In particular, the following important results were obtained:

a) The shielding performance was at least five times better than the conventional Portland cement, which means the products can use one fifth of the thickness that is normally used in nuclear industry, especially for neutron absorption.
b) Using simulated but radioactive K-Basin waste formulations, it was shown that the waste can be effectively immobilized to pass all regulatory requirements designed for disposal.
c) Using cesium (radioactive) as an example, it was shown that fission products can be effectively mineralized in crystal structure of Borobond and thus immobilized.
d) Finally, novel coating material was developed with excellent corrosion protection performance. Unlike conventional polymer based coatings, the new coating develops its own passivation layer on steel surface and protects the surface from atmospheric corrosion.

Summary of Technology Transfer Benefits to Industry:

Using the results of this project, the partner can expand its business by finding new markets and also bid for new contracts with DOE.

Other Information/Results: (Papers, Inventions, Software, etc.)

Two publications:

1. Arun S. Wagh, S. Yu. Sayenko, R.V. Tarasov, M.P.Dykiy, Y.O. Svitlychniy, V.D. Vyrych, an E.A. Ulybkina Experimental study on cesium immobilization in struvite structures, Journal of Hazarous Materials, 302(2016) 241-249.

2. Arun S. Wagh, S. Yu. Sayenko, A.N. ovbnya, V.A. Shkuropatenko, R.V. Tarasov, A.V. Rybka, an A.A. Zakharachenko, Journal of Nuclear Materials, 462 (2015) 165-172.

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