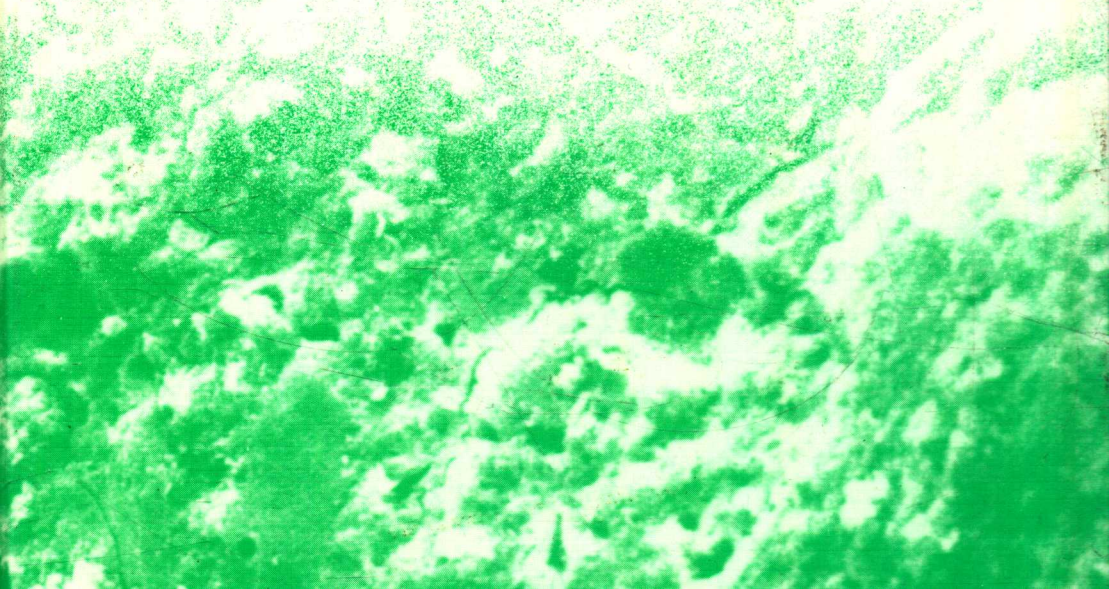
Volume 23

Ceramic Transactions

NUCLEAR WASTE MANAGEMENT IV

George G. Wicks • Dennis F. Bickford • L. Roy Bunnell



Volume 23

Ceramic Transactions

NUCLEAR WASTE MANAGEMENT IV

Edited by George G. Wicks and Dennis F. Bickford,
Westinghouse Savannah River Co., and
L. Roy Bunnell, Pacific Northwest
Laboratory

The American Ceramic Society, Inc.
Westerville, Ohio

Proceedings of the Fifth International Symposium on Ceramics in Nuclear and Hazardous Waste Management held during the 93rd Annual Meeting of The American Ceramic Society in Cincinnati, Ohio, April 29–May 3, 1991.

Library of Congress Cataloging-in-Publication Data

International Symposium on Ceramics in Nuclear and Hazardous Waste Management (5th : 1991 : Cincinnati, Ohio)

Nuclear waste management IV / edited by George G. Wicks, Dennis F. Bickford, and L. Roy Bunnell.

p. cm—(Ceramic transactions ; v. 23)

"Proceedings of the Fifth International Symposium on Ceramics in Nuclear and Hazardous Waste Management held during the 93rd Annual Meeting of the American Ceramic Society in Cincinnati, Ohio, April 29–May 3, 1991"—T.P. verso.

Includes index.

ISBN 0-944904-45-9

1. Radioactive waste disposal—United States—Congresses. 2. Radioactive waste disposal—New York (State)—West Valley—Congresses. 3. Glass waste—Environmental aspects—United States—Congresses. 4. Ceramics—Congresses. I. Wicks, George G. II. Bickford, D.F. (Dennis F.) III. Bunnell, L.R., 1943– . IV. American Ceramic Society. Meeting (93rd : 1991 : Cincinnati, Ohio) V. Title. VI. Title: Nuclear waste management 4. VII. Title: Nuclear waste management four. VIII. Series.

TD898.118.I57 1991

621.48'38—dc20 91-34194

CIP

Printed in the United States of America

1 2 3 4—95 94 93 92 91

ISBN 0-944904-45-9

Preface

In 1991, the American Ceramic Society was pleased to sponsor the fifth in a series of international symposia on nuclear waste management activities. The Fifth International Symposium on Ceramics in Nuclear and Hazardous Waste Management was held April 28–May 2 in Cincinnati, Ohio, as part of the 93rd Annual Meeting of the Society. The symposium was organized by the Nuclear Division of The American Ceramic Society, in cooperation with the Glass and Optical Materials, Cements, and Engineering Ceramics Divisions.

The symposium highlighted many interesting areas of waste management and emphasized engineering aspects of waste immobilization. Special emphases were placed on glass melting and processing, waste form process controls, and product qualifications. During the three-day symposium, 75 papers were presented in ten technical sessions. These sessions included HLW Program Overviews/Waste Form Characterization, Chemical Durability of Waste Forms and Products, Cementitious Waste Forms, Glass Melting and Processing—Chemical Considerations, Glass Melting and Processing—Melters, Microwave Applications in Waste Management, Waste Form Qualifications, Decontamination Studies, Waste Form Process Controls, and In Situ Vitrification/Repository Relevant and Field Testing of Waste Forms.

Participants at the symposium came from a variety of countries and organizations and included representatives from academia; federal, national, and international laboratories; governmental organizations; and industry. The organizers are grateful to their colleagues who participated in this effort and especially to those who chaired sessions and reviewed the many manuscripts for these proceedings. Included are S.O. Bates, M.K. Choudhary, D.E. Clark, K.B. Harvey, P.R. Hrma, V. Jain, C.M. Jantzen, C.A. Langton, R.A. Palmer, M.J. Plodinec, W.A. Ross, A.K. Sakar, and H.D. Schreiber. The organizers would also like to thank the U.S. Department of Energy for their support in publishing the symposium proceedings and The American Ceramic Society for their considerable time and help in this effort.

The symposium co-chairs would like to give a very special thanks and acknowledgement to Laura Jordan, who was Administrative Assistant for this entire effort. Without her help, the symposium would not have run as smoothly as it did, and the organization and quality of these proceedings are a reflection of her hard work and dedication.

George G. Wicks
Dennis F. Bickford
L. Roy Bunnell

Ceramic Transactions *is a new proceedings series designed to meet two needs: high quality content and rapid publication. Volumes in the series come from meetings, symposia, and forums. Each paper is reviewed by two peers, and final manuscripts are prepared by authors in a ''camera-ready'' format. The volumes in this series would not be possible without the hard work, dedication, and cooperation of editors, reviewers, and authors, who all deserve a great deal of thanks.*

Your comments, questions, and suggestions for future ***Ceramic Transactions*** *volumes are welcomed and should be addressed to the Director of Publications, The American Ceramic Society, Inc.*

Contents

Section I. HLW Program Overviews/ Waste Form Characterization

Section II. Chemical Durability of Waste Forms and Products

Section III. Cementitious Waste Forms

Section IV. Glass Melting and Processing —Chemical Considerations

Section V. Glass Melting and Processing —Melters

Section VI. Waste Form Qualifications

Section VII. Decontamination Studies

Section VIII. Waste Form Process Controls

Section IX. In Situ Vitrification/Repository Relevant and Field Testing of Waste Forms

Section X. Microwave Applications in Waste Management

Section I. HLW Program Overviews/ Waste Form Characterization

SAVANNAH RIVER SITE HIGH LEVEL WASTE PROGRAM AND THE DEFENSE WASTE PROCESSING FACILITY

William D. Pearson
U. S. Department of Energy
Savannah River Field Office
P. O. Box Box A
Aiken, SC 29802

INTRODUCTION

At the Savannah River Site (SRS) in Aiken, South Carolina, the residue of over thirty years of reprocessing of irradiated nuclear fuels for national defense purposes is currently stored in 51 carbon steel tanks. This is a volume of about 34 million gallons of high level radioactive waste. The Defense Waste Processing Facility (DWPF) is to immobilize the radioactivity in this waste. An overview of the SRS High Level Waste (HLW) Processing is shown in Figure 1.

OVERVIEW

Chemical separations of nuclear materials in the H and F canyons produce HLW as a process waste. Waste handling operations in the F-and H-Area Waste Tank Farms separate the process waste into three parts: highly radioactive insoluble sludge, highly radioactive precipitate, and less radioactive water soluble salts.

HLW TANK FARMS IN THE H AND F AREAS

The concentrated liquid radioactive waste byproduct of the SRS separations process is a strongly caustic solution of nitrate salts. An insoluble and highly radioactive metal oxide sludge is also present in some of the streams which are designated as High Level Waste. These waste streams are pumped from the separations facilities (canyon buildings) to the liquid radioactive waste handling facilities (called the waste tank farms) Located in F-Area and H-Area. The tank farm facilities consist of 51 underground waste tanks with a nominal capacity of one million gallons each. Each Tank Farm also maintains two evaporators for waste concentration, and extensive waste transfer systems.

Figure 1 Immobilization of Savannah River Plant Waste