

ESTABLISHING METHODS FOR RECYCLING SPENT ZIRCALOY CLADDING  
USING A HYDRIDE-DEHYDRIDE PROCESSING ROUTE

A Project Report

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by

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*“Deep is the well of truth and long does it take to know what has fallen into its depths”*  
- Friedrich Nietzsche, 1844-1900

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## TABLE OF CONTENTS

	Page
ABSTRACT .....	v
1. OVERVIEW .....	1
1.1 Justification for Research .....	2
1.2 Present Work .....	4
2. BACKGROUND .....	6
2.1 Zirconium Hydride .....	6
2.2 Zirconium Oxide .....	11
2.3 Trace Element Interactions .....	12
3. EXPERIMENTAL EQUIPMENT AND MATERIALS .....	13
3.1 Experimental Materials and Specimen Preparation .....	13
3.2 Glovebox Design .....	15
3.3 Hydride Process Design .....	17
3.4 Dehydride Process Design .....	22
4. RESULTS .....	24
4.1 Experiment Zy1 .....	28
4.2 Experiment Zy2 .....	30
4.3 Experiment Zy3 .....	31
4.4 Experiment Zy4 .....	32
4.5 Experiment Zy5 .....	33
4.6 Experiment Zy6 .....	34
4.7 Experiment Zy7 .....	35
4.8 Experiment Zy8 .....	36
4.9 Experiment Zy9 .....	37
4.10 Experiment Zy10 .....	38
4.11 Experiment Zy11 .....	39
4.12 Experiment Zy12 .....	40
4.13 Experiment Zy13 .....	41
4.14 Experiment Zy14 .....	43
4.15 Dehydride Apparatus Shakedown Test .....	46

5. DISCUSSION OF RESULTS .....	49
5.1 Hydride Experiments .....	49
5.2 Dehydride Test Apparatus Shakedown .....	54
6. SUMMARY AND RECOMMENDATIONS .....	56
LIST OF REFERENCES .....	59
APPENDICES	
Appendix A: Variac calibration curves.....	62
Appendix B: Experiment temperature profiles.....	65
Appendix C: Procedures.....	72
Appendix D: Equipment Photographs.....	75
VITA .....	84

## ABSTRACT

Kraemer, Dustin T. MSNE., Purdue University, August 2005. Establishing Methods for Recycling Spent Zircaloy Cladding Using a Hydride-Dehydride Processing Route.  
Major Professor: Sean M. McDeavitt.

Materials handling and processing equipment and early process development equipment were developed to recycle spent nuclear fuel cladding (i.e., Zircaloy) into a metal powder that may be used for advanced nuclear fuel fabrication. An inert atmosphere glove box for preparation and analyzing of specimens, a hydride process system, and a dehydride process system were designed and fabricated for the purpose of establishing feasibility of recycling Zircaloy cladding hulls from spent nuclear fuel. Initial experiment analysis established criteria for hydriding of tubular Zircaloy specimens. It was found that brittle hydrides can be formed from Zircaloy tubes and crushed to fine powder. The designed dehydride process was built to decompose the zirconium hydride powder formed through the hydride process. Initial analysis of the hydriding apparatus and design recommendations are made.

## VITA

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