FHR Integrated Research Project (IRP-2) Workshop 2

FHR Benchmark Workshop

Materials, Activation, Tritium and Transport (MATT) Working Group Agenda
Clark Kerr Campus – Clark Kerr Room
Berkeley, California
April 14-15, 2016

Materials, Activation, Tritium, and Transport (MATT): The focus of this working group is on benchmarking [description]. Many of the FHR materials, chemistry, and tritium challenges are in common with molten salt reactors and salt-cooled fusion reactors; thus, this working group is working with these other communities.

Instructions to MATT Breakout Participants

On the FHR workshop website for your information is a tritium discussion paper that summarizes our understanding of ongoing work for tritium control in 600 to 700°C liquid salts. If you have materials you want to share, they can be placed on that website. Each of the sessions will cover a specific subject. If you have specific work you which to report on, prepare one or two viewgraphs for the specific session. Any comments or viewgraphs can be sent in advance to C. Forsberg (cforsber@mit.edu) and Raluca Scarlat (raluca.o.scarlat@gmail.com)

http://fhr.nuc.berkeley.edu/april-2016-berkeley-fhr-workshop/

Day 1: Thursday, April 14, 2016 (*Clark Kerr Room*)

10:40 – 11:00 **Introduction: MATT Benchmark Goals**
Facilitators: Dr. Charles Forsberg, Dr. Kumar Sridharan and Dr. Raluca Scarlat

11:00 – 12:00 **Session 1: Tritium management options (excluding carbon), and system modeling**
Facilitators: Floren Rubio (UNM) and Nisarg Patel (UW)

1. Other tritium separation techniques (excludes tritium on carbon)
2. System modeling – need input from: MIT/SINAP, Stephen Lam

Questions:

1. What are the current activities on tritium management options? (excluding absorption on carbon)
2. What are the current and future activities on system-level tritium modeling?
3. What multi-physics coupling is needed?
4. Current activities and capabilities for tritium permeation barriers? – Get input from Kumar Sridharan – mention INL start facility – mention cold spray capability at UW

12:00 – 1:15 **Lunch – All WGs**
Lunch Talk: SINAP TMSR program update

1:15 – 3:30 **<u>Session 2:</u> Graphite**

Facilitators: Huali Wu & Nisarg Patel (UW)

Topics:

1. Graphite characterization
2. Salt-graphite interaction
3. Tritium in carbon
4. Other species in carbon: corrosion products, activation products

Questions:

What is status of work? What are future plans? How to integrate the results?
What specific carbon forms for benchmarking?
Graphite, matrix, carbon-carbon, etc.
Availability of irradiated graphite, for in-core carbon
What else gets removed by carbon (silver for FHR, all noble metals for MSR, etc.)
Salt-carbon interface—how approach?
Hydrogen
How much hydrogen off-gassing from fresh fuel?
Add hydrogen to drive down tritium inventories or reduce releases?
Tritium source term during reactor transients?

3:30 – 3:45 **Break**

3:15 – 4:00 **<u>Session 3:</u> Salt Chemistry**

Facilitators: Francesco Carotti, Tom Chrobak & Dr. Ruchi Gakhar (UW)

Topics:

1. Electrochemistry
2. Spectroscopy
3. Purification
4. Solubility, diffusion coefficients
5. Beryllium safety
6. Redox control

Questions:

What is the status of the work in this field? (Salt Chemistry, Electrochemistry, Purification)
Melt manufacturing: reporting and measuring LiF-BeF_2 ratio.
Purification options: Gas treatment (various options). Can electrochemistry be used for purification?

What measurements and techniques should be used to benchmark for the chemical quality of flibe used for experiments? How can we set quality standards?
What can we learn about Tritium and Material transport using electrochemistry?
What might be the sources of hydrogen (tritium) in Flibe to study hydrogen (tritium) transport from salt to graphite ?
Future Plans ?
Estimation of corrosion products in Flibe – study of diffusion coefficients of corrosion p roducts

Electrochemistry of graphite-salt interface
Transport of activation products and corrosion products – solubilities, diffusion coefficients
Optical spectroscopy of the liquid salt, and other salt chemistry characterization techniques
Metal fluoride solubility in flibe and volatility (partial pressure)

Day 2: Friday, April 15, 2016 (*Clark Kerr Room*)

9:15 – 10:00 **<u>Session 4:</u> Corrosion**
Facilitators: Tom Chrobak & Karl Britsch (UW)
Topics :

1. Redox Control – corrosion and transport of tritium and other species
2. Metallic alloys
3. Effect of graphite
4. Ceramics and composites
5. TRISO fuel
6. Effect of radiation damage on corrosion (salt radiolysis) – input from Tony
7. Flow-assisted corrosion

Questions:
What are the choices for redox control in the salt (or do we need it)?
What is the effect of Redox Potential and salt Chemistry on tritium transport?

10:00– 10:15 **Break**

10:15 – 11:00 **<u>Session 5:</u> Path Forward**
Facilitators: Dr. Charles Forsberg, Dr. Kumar Sridharan and Dr. Raluca Scarlat

1. **Benchmarking goals**
2. Group progress overview
3. Next MATT workshop at UW (expert suggestions)

Benchmarking :

Establishing a standard material stock for the representative materials being studies by different groups (graphite, salt, steel alloy) on which everyone can perform baseline measurements.
Establishing standard conditions for benchmark measurements - temperature, cover gas purity etc.
Establishing a standard set of parameters to be reported for salt purity
Establishing a standard set of parameters to report on hydrogen barriers
Establishing a standard set of parameters to be reported for materials - eg. composition of steel alloys, pre-treatment procedure of graphite etc.
Establish a simple system-level tritium transport benchmark problem with all inputs fully defined.
Fuel-element model?