Status of J-PARC Transmutation Experimental Facility

10th OECD/NEA Information Exchange Meeting for Actinide and Fission Product Partitioning and Transmutation

2008.10.9

Japan Atomic Energy Agency

Toshinobu Sasa
Current Status of J-PARC
Operation history of J-PARC

- 2002.3 Start Construction
- 2006.11.22 Accelerate first beam
- 2007.1.24 Success to accelerate proton to 181MeV
- 2007.10.31 Success to accelerate proton to 3GeV
- 2008.5.27 Success to inject 3GeV beam to 50GeV ring
- 2008.5.30 Success to produce spallation neutron
Status of J-PARC: LINAC

Aug. 10, 2008 Exhibition to public
2,600 person were visited
Status of J-PARC: Others

- Mercury Target
- Injection to 3 GeV Synchrotron
- MLF Experimental Hall
- Hadron Experimental Hall
Current Condition of TEF Location
Activities for TEF user community

- **Working party for ADS**
  - Organized by Japan Atomic Energy Research Institute from 1999 to 2006
  - Study of critical assembly for innovative nuclear systems including ADS

- **Call for Letter Of Intent for Transmutation Experimental Facility**

- **Symposium for Actinide Management**
  - Held in Dec., 2007 at Tokyo (Organized by JAEA)
  - Discuss about the requirements for neutronic experiments for actinide management

- **Special Session for utilization of TEF in Annual Meeting of Atomic Energy Society of Japan (AESJ)**
  - Held in Mar. 2008 at Osaka (Organized by Reactor Physics Division of AESJ)
  - Agree to launch research committee for next-generation critical assembly

- **Meeting on future perspective for reactor physics research**
  - Held in Jun. 2008 at Tokyo (Organized by Reactor Physics Division of AESJ)
  - Confirm future needs for neutronics experiments for minor actinides, etc.

- **Research Committee for Neutronic Experimental Facility for Actinide Management**
  - Started from Jul. 2008 (Duration : 2 years)
Current Summary of Pre-LOI

- **Total Number of Proposals: 38**
- **Research Field and Items**
  1. ADS (Accelerator coupling, Multi-region core, Subcriticality measurements, etc.)  11
  2. Innovative Reactors (MA Neutronics, Heavy Metal Reactor, FP Transmutation)  10
  3. Nuclear Data Measurements (TOF, Threshold Reaction)  6
  4. Shielding, Safety  5
  5. Particle Physics (Ultra Cold Neutron, Neutrino)  3
  6. Pb-Bi Target Development (Irradiation)  2
  7. Medical Application (Boron Neutron Capture Therapy)  1

- **Abroads**
  - EUROTRANS
  - PSI (Swiss)
  - CIAE (China)
  - Seoul Univ. (Korea)
  - MINT (Malaysia)
  - NTI (Serbia)

- **Universities**
  - Hokkaido Univ.
  - Tokyo Tech.
  - Nagoya Univ.
  - Kyoto Univ.
  - Kyushu Univ.
  - Tohoku Univ.
  - Niigata Univ.
  - Osaka Univ.
  - Kinki Univ.

- **Company**
  - Engineering Development inc.

- **Company**
  - JAEA, KEK:26
  - J-PARC Center

**Researchers**: 113

**Abroads**: 56

**Universities**: 30
R&D and experimental needs for FR

- **Expectation for fast reactor neutronic experiments**
  - Data preparation for licensing beyond 2015
  - Prepare higher-Pu&MA-bearing fuel data by integral experiments
  - Heterogeneous MA loading
  - Reactivity worth measurements
    - Preparation of experimental methods and data for capture reaction
    - Systematic experiments by spectrum adjustment
  - Mockup experiments for FaCT backup concepts (Metal-FR etc.)
  - Experiments for LLFP Transmutation
R&D and experimental needs for LWR

- **High burnup**
  - Experiments with more than 5wt% EU fuel
  - Experiments for new materials (cladding, poison, etc.)

- **MOX fuel**
  - Burnup experiments
  - Study for higher-ordered Pu
  - Parametric survey for Pu isotopic composition
  - Survey for fuel lattice structure
  - Experiments with MA-doped fuel

- **Burnup credit**
  - Experiments with actual spent fuel
  - Experiments for nuclides with large reactivity influences
Needs for innovative systems

- **Water-cooled Thorium Breeder**
  - Experiments for Heavy water coolant, MFR=1.0, 7-8% Enriched U-233

- **Reduced-moderated LWR**
  - Simuration of midium-energy neutron spectrum
  - Sensitivity at entire energy range (Fast-resonance-thermal)
  - Experiments with MOX Blankets
  - Experiments with original-lattice structure

- **Accelerator-driven system (ADS)**
Research Committee in AESJ

- **Research Committee on “experimental facility for reactor physics concerning actinide management”**
  - Around 30 reactor physics experts from Universities, Research Institutes, Companies

- **Objectives**
  - survey needs for neutronic experiments necessary for actinide management
  - specify the requirements for experimental methods, devices, equipments and experimental facility design
  - clarification of issues for effective use of experimental facility in the field of scientific research, education and publicity

**Recommendation to TEF will be summarized in this fiscal year**
Facility Image of TEF 1st Phase

- 2 steps construction
- 1st: TEF-P
- 2nd: TEF-T+SC-LINAC
Transmutation Physics Experimental Facility

- Low power critical facility for reactor physics and nuclear data of transmutation systems including ADS and FBR.
- Neutron source: $10^{12}$ n/s, 25Hz. 1ns pulsed beam can be supplied by laser charge exchange technique.
- By replacing central 5 x 5 matrix tubes with pin-type assembly, MA fuel can be used with cooling and remote handling.

Thermal power: 500W
Effectiveness of MA-bearing fuel

Specify importance of MA fuel experiments

Simulate neutron spectrum of actual FBR and ADS
- MOX+5%MA fuel, ADS fuel are installed in TEF-P driver zone (25cm×25cm×60cmL)
- Add 7 simulative experiments to existing data
Characterize effect of MA fuel experiments
It is also found that cross section and covariance data must be checked

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<th>(MA, Pu)N + ZrN Fuel</th>
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Handling for MA-bearing Fuel

- Performing preliminary study for remote handling
- 6 fuel pins are stored in stainless cartridge for shielding and protecting critical accident
- Handling at storage and reactor room is done by remote devices
- MA fuel storage equip the local cooling circuit connected to emergency power supply
Summary

- Explore experimental needs and requirements for next-generation Critical Assembly, TEF
  - Data required to improve existing reactor systems
  - Experimental devices to study innovative nuclear systems
  - Researches for innovative nuclear fuel concepts
  - Neutronics with various neutron/proton beam
  - AESJ Research Committee presents recommendation to TEF

- R&D for TEF-P
  - Analyses for TEF-P and its effectiveness for MA physics
  - Study for MA-bearing fuel (Fuel form and handling)
  - Updating facility plan by reflecting user needs
Draft Schedule for TEF Construction

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National Review by Atomic Energy Commission
Formulate next mid-term plan of JAEA

MA Experiments