



Contribution ID: 783

Type: **Poster**

## **PD/P8-01: Use of Subcritical System in the Nuclear Fuel Cycle in China**

*Friday, 12 October 2012 14:00 (4h 45m)*

The world needs a great deal of carbon-free energy for civilization to continue. Nuclear power is attractive for helping cut carbon emissions and reducing imports of fossil fuel, but the low utilization of nuclear resource and hard to processing of spent fuel from nuclear power plant are now the key issues for nuclear development. Subcritical system which including Fusion Driven subcritical System (FDS) and Accelerator Driven subcritical System (ADS) might be the potential way to resolve these problems. Since the subcritical system first carried out in 1950s, and many concept designs and R&D have been achieved in the past few decades, the subcritical system became a hot research in recent years, especially the ADS. A FDS concept named FDS-SFB (Fusion Driven subcritical System for Spent Fuel Burning) and an ADS concept named CLEAR-III (China LEad Alloy cooled Reactor) have been proposed and designed based on viable technologies, which could be used for waste transmutation, nuclear fuel breeding and energy production.

In this contribution, the concept designs and analysis which including the neutronics, the structure, thermal hydraulics, safety of FDS-SFB and CLEAR-III have been introduced, and a serial of fuel cycle strategies which coupled a kind of typical reactor i.e. Pressure Water Reactor (PWR), High Temperature Gas cooled Reactor (HTGR) and Fast Breeder Reactor (FBR) with FDS-SFB or CLEAR-III were presented, seven fuel cycle models were achieved and the energy flow analysis, mass flow analysis and economy analysis of the coupling system were carried out to evaluate the performance of different fuel cycle strategies. The results shown the advanced fuel cycle based on subcritical system is a very attractive option for fuel breeding and waste transmutation, the fuel utilization and the waste production of nuclear energy will be greatly improved compared with other strategies.

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**Session Classification:** Poster: P8

**Track Classification:** PD - Post Deadline