

Technical Meeting on Advanced Technology Fuels: Progress on their Design, Manufacturing, Experimentation, Irradiation, and Case Studies for their Industrialization, Safety Evaluation, and Future Prospects

Contribution ID: 6

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THE IPEN/CNEN (BRAZIL) CONTRIBUTION TO ATF-TS CRP

Thursday 30 October 2025 09:00 (25 minutes)

Introduction

Since the Fukushima Daiichi nuclear accident, the vulnerability of current fuel designs under severe accident conditions has been widely recognized. As a result, alternative and advanced fuel designs that offer greater resistance to fuel failure and hydrogen production have been actively explored. In this context, at the request of Member States, the IAEA has organized several Technical Meetings[1] and Coordinated Research Projects (CRPs)[2,3] to support the design and development of Accident Tolerant Fuel (ATF) technologies.

The IPEN/CNEN participated in the two most recent CRPs, FUMAC[2] and ACTOF[3] by performing fuel performance simulations for different ATF fuel designs under both normal and accident conditions. These simulations were conducted using the FRAPCON/FRAPTRAN [4,5] and TRANSURANUS[6] codes. The objective of this work is to present an IPEN/CNEN contribution to ATF-TS CRP.

Initially, the proposed activities involved the assessment and modification of the TRANSURANUS code to account for FeCrAl cladding, enabling the simulation of separate-effect burst experiments and the development of a LOCA evaluation methodology.

This methodology was based on the IFA-650 [7] experimental series and considered various LOCA accident scenarios, including SBLOCA, LBLOCA, and DEC-A. Moreover, was included experimental work to be performed at IPEN/CNEN laboratories, specifically oxidation and burst experiments for cladding based on iron alloy. However, due to the global COVID-19 outbreak, these experimental activities could not be carried out as planned.

ATF-TS CRP Scope

As recommendation of the previous CRP's dedicated to ATF[1,4], the CRP ATF-TS was created and starts at 2021 and still in progress with 22 member states participation aiming to support their efforts to design and development an accident tolerant for light water reactors in order to increase the safety and reliability.

This CRP consists of four different groups and objectives:

☒ Work task 1: is dedicated to conducting single rod and bundle experimental tests using potential candidates for Accident Tolerant Fuels. These tests aim to evaluate the performance and behavior of ATF materials under various conditions, helping to identify promising candidates for further development, as well as obtain material properties data useful for fuel performance codes.

☒ Work task 2: is focused to benchmark fuel performance codes by considering experiments conducted in Work task 1, as well as existing tests and data on advanced fuel, including cladding materials. By comparing simulation results with experimental data, this work task aims to improve the accuracy and reliability of fuel performance predictions.

☒ Work task 3: aims to evaluate Loss-Of-Coolant Accident (LOCA) methodologies using a best estimate plus uncertainty approach for nuclear power applications in order to enhance safety assessments for reactor operation and design.

☒ Work task 4: is dedicated to compiling a comprehensive database of available material data, properties, and correlations for ATF materials. Moreover, aims to create a valuable open-source resource for researchers and engineers. By centralizing relevant information will facilitates access to critical data needed for ATF development and implementation.

The aims of this work is to present activities related to the work task 2, which intend to contribute to benchmark the fuel performance code TRANSURANUS [6] through an experiment similar to PUZRY experiment [7] performed at Hungarian AEKI –Center for Energy Research for FeCrAl alloy cladding under framework of ATF-TS CRP. Moreover, validates existing data and properties of FeCrAl alloy from open literature [8].

ACKNOWLEDGEMENTS

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