ECC-SMART
Project Newsletter
August 2022

Dear Nuclear enthusiasts,

We are glad to share with you a third external newsletter of the ECC-SMART project. In the previous newsletters, you could become acquainted with a general project overview and objectives of all six work packages. This time, we would like to zoom in on the draft of the SCW-SMR design with an emphasis on the inter-connection of work packages.

The first half of the project is already gone with good results. The European Commission approved all the steps fulfilled up to now and we gladly announce that the project is on track. Appreciation goes mainly to WP leaders that manage their work packages, and of course, gratitude to all project partners who contribute to the successful project implementation.

We are now approaching a more practical period of the project, with tangible results that the Nuclear community is eagerly expecting. After the challenging situation we had with the pandemic, we are finally organizing the first in-person project meeting. You can follow the ECC-SMART project and find more information on our sites below.

Sincerely,
ECC-SMART Coordination team

FIND OUT MORE!

CORDIS
EU research results

PROJECT PROGRESS OVERVIEW

Currently, all technical WPs are successfully contributing to project's main motivation to demonstrate the feasibility of the SCW-SMR concept. The progress of the technical WPs is briefly described below. All results are serving as a basis for the establishment of a list of design requirements that will serve as a reference document for the future conceptual design.

WP2 Materials Testing

- The test matrix was established including more than 700 specimens.
- 310S and 800H were selected as the prospective materials for fuel cladding for concepts based on SCWR.
- The AFA (Alumina Forming Austenitic alloy) was also included and supplied by colleagues from China to support the progress in the SCWR and SCW-SMR field and international collaboration.
- The conditions for tests were based on relevant calculations done in cooperation with the Canadian partner.
- Various experiments focused on corrosion, mechanical properties and effect of neutron irradiation were started and the first results are being evaluated.

WP3 Thermal-hydraulics and safety of the SCW-SMR

- The innovative design concept of a SCW-SMR has been proposed based on a high-performance light water reactor (HPLWR) including the experiences of Canada and China.
- The extension of the reference database has been started based on the data provided by the project partners.
- Two benchmarking activities are defined, and the work is in progress to improve codes (system, subchannel and CFD) with a focus on the SCW-SMR concept.
- The coupling of analysis as well as improvement of application of codes are ongoing.
- The experiments dealing with the effect of corroded surfaces on thermal-hydraulic are implemented.

WP4 Neutron physics of SCW-SMR

- A computational benchmark model was proposed and published.
- The effective multiplication factor, the axial power distribution within the fuel, the axial three-group neutron flux distribution, as well as the spatial distribution of the energy deposition due to neutron and photon interactions were determined.
- Detailed MCNP and Serpent MC models of the SCW design concept suggested by WP3 have been developed.
- Extensive core design work, as joint effort of WP3 and WP4 has been started to achieve setup targets.
- Monte Carlo simulations have been performed to achieve feasible (in terms of neutronics) reactor core configurations.

WP5 Synthesis & Guidelines For Safety Standards

- The review report on safety criteria and requirements for the SCW-SMR concept was completed.
- The outputs and progress performed in technical WPs are being progressively gathered to prepare a consistent set of the main safety-related findings with a focus on pre-licencing and safety, security and safeguards documentation

WP6 Dissemination & Communication

- Project website and LinkedIn established and running.
- Project visual identity such as logo, templates, colour scheme created.
- Data Management Plan drew up and continuously updated.
- Communication and dissemination of the project and its results ensured.

JOINT EUROPEAN CANADIAN CHINESE DEVELOPMENT OF SMALL MODULAR REACTOR TECHNOLOGY

This project has received funding from the Euratom Research and training programme 2019-2020 under Grant Agreement No 945234.

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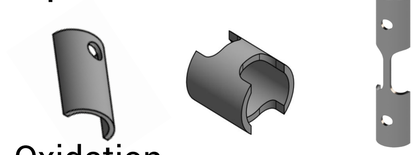
The ECC-SMART project is fully aware of the power of its project consortium consisting of 20 partners from Europe, Canada and China. All partners work together benefiting from the trans-continental synergy and knowledge developed by each partner separately and using the best facilities and methods worldwide to fulfil the common vision of building an SCW-SMR in the near future. The successful implementation of the project is, however, conditioned by effective cooperation not only between individual partners but also among work packages.

WP1 Coordination

WP2 Material Testing

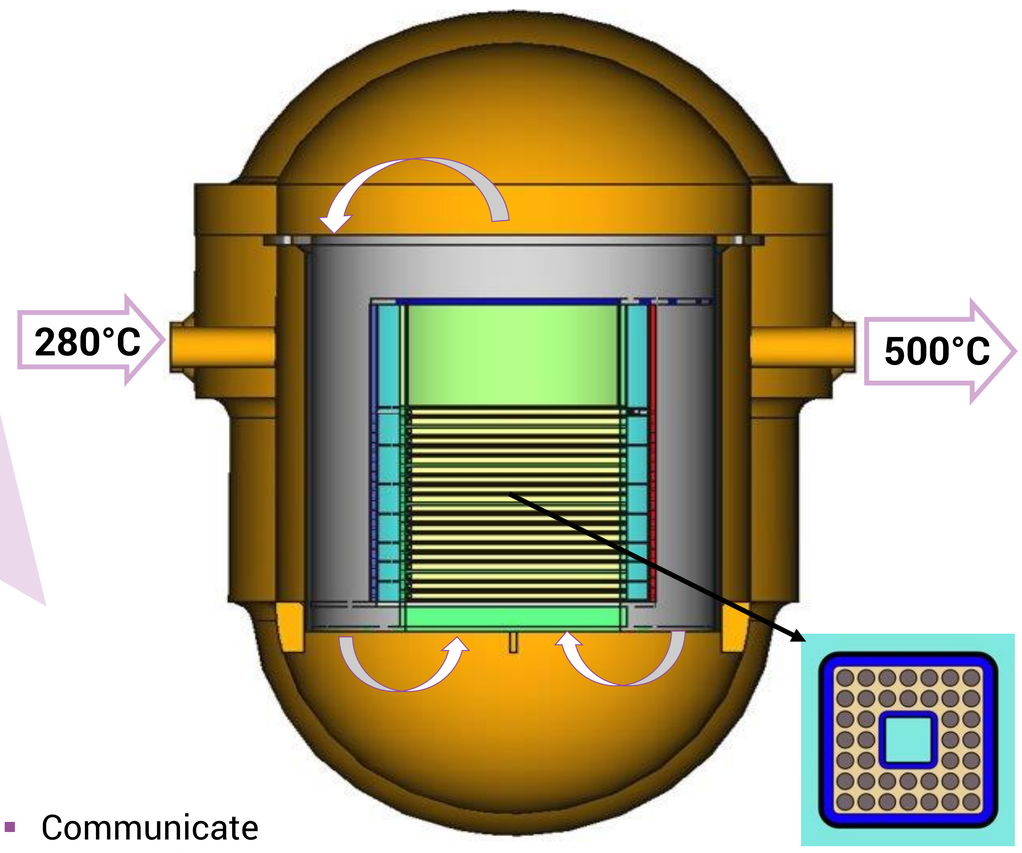
- Fuel cladding as a crucial issue from material point of view.
- Main set up of specimens is manufacture from tube → closer to reality.
- Tests focused on radiolysis and irradiation by neutrons and protons.
- Assessment of of **EAC** in longitudinal and circumferential directions under SCW-SMR estimated conditions.
- Assessment of **corrosion behaviour** via exposure and electrochemical tests at average and highest calculated temperatures.
  → **Description of oxide layers and roughness to be further included in experiments planned in WP3**

Specimens:



Oxidation coupons | Tensile specimens

Cross-section of the SCW-SMR core



Cross-section of fuel assembly

WP3 Thermal hydraulics & safety

- Heat transfer correlation, development and validation.
- System code development and implementation.
- The experiments and simulation of thermohydraulic including of corrosion layer formed during the live cycle of fuel cladding.
- Propose design of the core to be further assessed by WP4.

WP4 Neutron physics

- Find core layout for at least 2-year-long burn up cycle
- Feedback for WP2 and WP3 on material selection, design modification, and temperature of moderator
- Assessment of the proposed design of fuel assembly and core layout
  → verify:
  - Ratio of MOX and UO2;
  - the enrichment of UO2;
  - appropriate codes for calculation;
  - temperature of moderator;
  - number of fuel rods;
  - assembly gaps;
  - geometry of FA.

WP5 Synthesis & guidelines for safety standards

- Collecting the inputs from WP2, 3 and 4.
- Uncovering:
  - Knowledge gaps,
  - Safety requirements,
  - Design requirements,
  - Future challenges,
  - How to approve the design of future SCW/SMR.

WP6 Dissemination & Communication

- Communicate &disseminate the project and its results
- Involve the students and young scientists.
- Open the discussion on future of SMR.
- Increase the interest in future SMR.

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