

# IRRADIATION AND TESTING OF BLANKET FIRST WALL MOCK-UPS

## Call for Nominations

### **Purpose**

The purpose of this contract is to evaluate the effects of neutron irradiation on the beryllium/heat sink copper alloy (CuCrZr) armor joint in Blanket First Wall (FW) mock ups representative of the so-called “Enhanced Heat Flux” design.

### **Background**

ITER (“The way” in Latin) is a next generation fusion tokamak designed “to demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes”. With a long lifespan over than 30 years, it is intended that ITER will be a single step between the current set of fusion experiment and DEMO, a fusion power plant designed to demonstrate safe and reliable, commercial electricity production.

The ITER Organization consists of 7 Parties, acting through the Domestic Agencies (CN, EU, IN, JA, KO, RF, US) each of them will have a role in supplying most of the systems. The ITER Organization has the overall responsibility for the design and operation of the machine.

The ITER FW is manufactured using two technologies, Normal Heat Flux (NHF) for loading up to 2 MW/m<sup>2</sup> and Enhanced Heat flux (EHF) for loading up to 5 MW/m<sup>2</sup>.

This contract concerns the irradiation test campaign for the ITER FW EHF technology. Mock ups representative of the final EHF design are to be subjected to an experimental campaign to evaluate the effects of neutron irradiation on the material properties and in particular, the effect on the beryllium/heat sink copper alloy (CuCrZr) armor joint. High heat flux testing shall be the approach used to make the comparative assessment of joint performance.

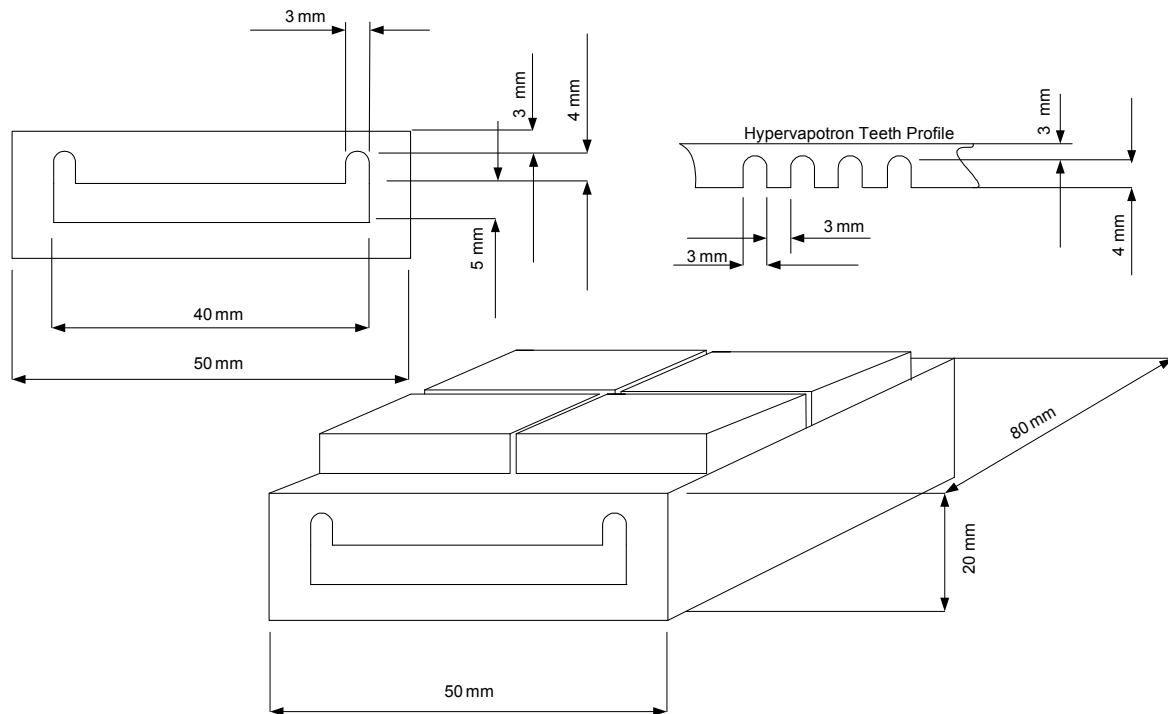
### **Scope of work**

The supplier shall be responsible for the full scope of activities relating to the irradiation and high heat flux testing of EHF FW mock ups.

A total of 14 mock-ups, manufactured in Russia and China (7 each), will be delivered to the supplier as free issue items.

In order to reduce costs, there is the option of having the whole programme carried out on 8 mock-ups, namely 4 from Russia and 4 from China.

Figure below shows a typical size and geometry of the mock-ups to be neutron irradiated and high heat flux tested.



The contract is split into four phases. The signature of the contract releases Phase 1 and 2. The release of the following Phases 3 and 4 is subject to the successful completion of the previous phases.

**PHASE 1:** (1) Definition of all interfaces associated with the test facilities to ensure correct installation of EHF FW mock ups; and (2) Development of a detailed plan and procedure for all the activities foreseen in Phases 2, 3 and 4, including supplier/subcontractor activities.

**PHASE 2:** (1) Incoming inspection of EHF FW mock ups (free issue items); (2) High heat flux (HHF) testing of the unirradiated EHF mock ups; (3) Implementation of specified irradiation program including selection and management of sub-contractor.

**PHASE 3:** (1) Implementation of transportation activities (2) Neutron irradiation of all the specified mock-ups; (3) Shipment of the irradiated mock-ups to the HHF test facility.

**PHASE 4:** (1) HHF testing of the irradiated mock-ups; (2) Post mortem analysis of any failures; (3) Disposal of EHF FW mock ups following completion of the program.

The estimated duration for this work is completion of all activities by Dec 2014.

#### Technical Specification of Neutron Irradiation and HHF testing

- Irradiation levels are set at low dose 0.1-0.3 dpa and high dose 0.6 – 0.8 dpa in the beryllium armour (the tolerance on selected irradiation level is  $\pm 0.05$  dpa) at 200 – 250 °C (the tolerance on selected irradiation temperature is  $\pm 10$  °C).
- Thermal mapping shall be performed at 2 MW/m<sup>2</sup> for all the delivered FW EHF mock ups before irradiation.

- Thermal fatigue tests shall be performed for non-irradiated and irradiated FW EHF mock ups at  $2 \text{ MW/m}^2$  and  $5 \text{ MW/m}^2$  for 500 cycles at each stage. Maximum 12 mock ups (minimum 6 mock ups) are to be tested under HHF loads.
- Following completion of the test program or in the event of failure of the bond joint, a post mortem examination by microscopy shall be undertaken on all the mock-ups and a report generated. Number of post mortem analyses and samples to be agreed with IO.

## **Selection criteria**

Companies to be invited to tender will be selected based on the following criteria:

- Relevant experience and technical and engineering capability: The Tenderer must prove to be able to provide in an organised way the competences specified in the Scope of Work above.
- Organisation ability: The Tenderer must prove how the competences have been integrated in the past in relevant projects. Experience in nuclear plant or in fusion experimental plants is a matter of preference.
- Language ability: The language used at ITER is English. A fluent professional level is required (spoken and written English).

During the selection phase, ITER Organization reserves the right to contact some or all of each nominated company's references to ask if: (1) the nominated company delivered a quality product which was compliant with the customer's requirements; (2) the company's performance conformed with the terms and conditions of its contract, including the delivery schedule; and (3) the company was reasonable and cooperative during performance and committed to customer satisfaction. ITER Organization may choose to visit customer references and may also use other sources of information.

## **Candidature**

Candidature is open to all companies participating either individually or in a grouping (consortium) which is established in an ITER Member State. A consortium may be a permanent, legally-established grouping or a grouping, which has been constituted informally for a specific tender procedure. All members of a consortium (i.e. the leader and all other members) are jointly and severally liable to the ITER Organization.

The consortium groupings shall be presented at the tender submission stage. The consortium cannot be modified later without the approval of the ITER Organization.