

**RERTR 2018 – 39TH International Meeting on
Reduced Enrichment for Research and Test Reactors**

**November 4-7, 2018
Sheraton Grand Hotel and Spa
Edinburgh, Scotland**

**Performance of two COBRA-HEU LTAs with Gadolinium Absorbers
Irradiated in the BR2 Reactor**

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ABSTRACT

Two COBRA-HEU LTAs with gadolinium absorbers in the fuel meat are currently in the process of being irradiated during six BR2 reactor cycles in the framework of the BR2 HEU-LEU conversion project. The purpose of these irradiations is to determine the effect of the replacement of the current BR2 fuel element with B₄C and Sm₂O₃ as burnable absorbers by the new COBRA-HEU-type fuel elements with a slightly different geometry and with Gd₂O₃ as burnable absorber. During the development process of these COBRA-HEU LTAs, extensive feasibility studies were conducted on the nature, quantity and location of the burnable absorbers to be placed in the COBRA-HEU fuel element.

Prior to the current COBRA-HEU LTAs irradiation campaign, various irradiation scenarios for the loading pattern of each LTA in the BR2 reactor were studied. For this, a detailed MCNP6 geometry and burn-up model was developed for determining the performance graph of the reactivity evolution vs. the mean ²³⁵U burn-up of the COBRA-HEU LTAs. These numerical studies are complemented by a nuclear measurement programme accompanying the irradiation campaign of the COBRA-HEU LTAs. With this programme the reactivity difference of the COBRA-HEU LTAs relatively to a fresh current BR2 fuel element was determined as a function of the accumulated burn-up. Next to this neutronic measurement programme, the irradiation campaign comprised other parts, such as inter-cycle wet-sipping, visual inspections and hydraulic measurements.

This paper will present the results of the numerical studies as well as of the measurement results of the irradiation campaign encompassing five BR2 reactor cycles.