CABRI CIP0-1 Preliminary Test Results

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In 2001, IRSN has launched an international program devoted to the study of high burn-up fuel behaviour in RIA conditions. This program supported by several organizations representing ten countries is composed of twelve tests to be performed in the CABRI reactor. The two first experiments (CIP0 series) were achieved in the present sodium loop of the CABRI reactor whereas the next ones will be performed in a new pressurized water loop more representative of pressurised water reactor cooling conditions.

CIP0-1 and CIP0-2 tests were successfully conducted in November 2002 and used UO_2 fuel at about 75 GWd/t and respectively Zirlo and M5 advanced claddings.

The CIP0-1 parent rod was examined and re-fabricated in the Studsvik Labs (Sweden). The non-destructive examinations showed an average corrosion level of 75 microns, but without evidence of initial spalling but underlined a high mean hydrogen content and hydride concentrations at pellet-pellet interfaces.

In the CIP0-1 experiment, a power transient with a 32 ms pulse width and 98 cal/g energy injection at peak power node, was triggered resulting in a maximum average fuel enthalpy of 90 cal/g.

During the test, the instrumentation (microphones, flow meters, pressure transducers, void detectors,...) recorded a late event 1.26s after the pulse onset, which initially could be interpreted as a clad failure.

Later on, a careful visual inspection of the rod did not reveal any indication of clad failure, but an important spalling, i-e at many locations, the remaining zirconia layer thickness is as low as 10 microns.

Moreover, the gamma scanning focused on 85 Kr exhibited a peak in the plenum region indicating an amount of fission gas in the plenum consistent with the estimated transient release. This information could be interpreted as a sign of rod tightness.

Nevertheless, conclusive information on clad integrity is expected to be obtained by the rod puncturing and subsequent gas analysis that is foreseen in fall 2003.

It will be followed by a program of destructive examinations aiming at giving information on the post-test fuel microstructure.