

## FUEL ELEMENTS FOR THE IEA-R1M RESEARCH REACTOR

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The fuel element fabricated at IPEN is a M.T.R. type fuel constituted initially by  $U_3O_8$ -Al dispersions with 20 wt% enriched uranium. This fuel was perfectly qualified during the reactor operation for the maximum local burnup to 50%. Due to the need of higher uranium contents in the fuel meat because of operational and production reasons, IPEN started producing in 1999 a new type of fuel based on  $U_3Si_2$ -Al dispersions, and since March 1999 these fuel elements have been irradiated with good performance in the IEA-R1m reactor. Such kind of fuel admits increasing of uranium contents from 2.3  $gU/cm^3$  (maximum uranium content for  $U_3O_8$ -Al fuel type) up to 4.8  $gU/cm^3$ . The maximum adopted uranium content for fabrication reasons is 3.1  $gU/cm^3$ .  $U_3Si_2$  powder was initially imported from the international market. Since October 2004 after concluding the development of nuclear  $U_3Si_2$  type fuel for research reactors program, IPEN/CCN started producing its own  $U_3Si_2$  powder. It is also important to say that the whole core of the IEA-R1 research reactor of IPEN is actually composed by fuel elements fabricated here at CCN; 24 fuel elements have been supplying the reactor at the present time (17 composed by  $U_3O_8$ -Al and 7  $U_3Si_2$ -Al). The fuel meat is fabricated according to conventional powder metallurgy techniques. A pattern fuel element contains 18 fuel plates, each one with 1.52 mm thickness. Cladding and frame plates are made with the ASTM 6061 aluminum alloy. The fuel assembly is performed with the well-known picture-frame technique, according to (FIG.1). A mounted pattern fuel element results from mechanical assembly of 18 fuel plates and other structural components, as shows (FIG.2). The amount of fuel plates produced in 2002, 2003 and 2004 and the main parameters of a pattern fuel element are shown in (TAB.1). (FIG.3) presents the historical evaluation of fuel elements fabrication here at IPEN-CCN.

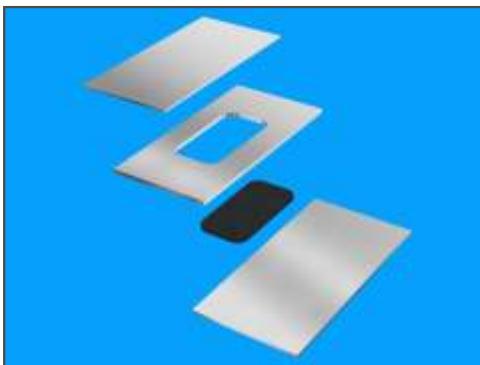


FIGURE 1 - fuel assembly, according to picture-frame technique.

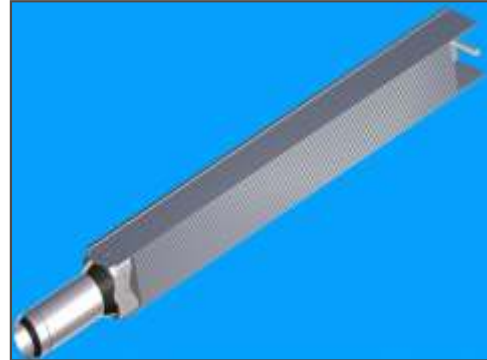


FIGURE 2 - pattern fuel element fabricated at IPEN-CCN.

TABLE 1 - number of fuel plates fabricated at CCN and main parameters related to a pattern fuel element.

Fuel plates fabricated	2002	2003	2004
$U_3Si_2$ -Al	-	-	-
$U_3O_8$ -Al	90	72	72
Parameter		$U_3O_8$	$U_3Si_2$
Compound content (g)		1254	1517
[Uranium] ( $g/cm^3$ )		2.3	3.1
Uranium content (g)		1062	1399
$^{235}U$ content (g)		211	279
Total Length (mm)		873	
Width (mm)		75.9 x 79.8	

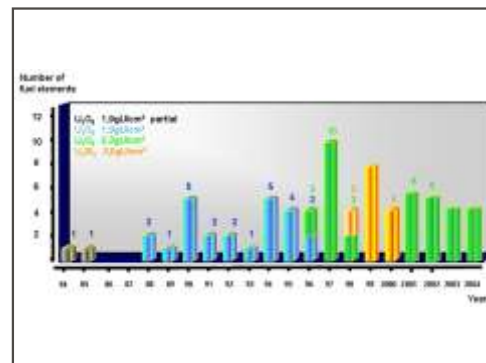


FIGURE 3 - Fabrication of fuel element for the IEA-R1, research reactor