

## Installation and verifying experiments of the Laser Flash Apparatus for the Thermal Diffusivity Measurement

150

Laser Flash 가  
Pyroceram 9606 .  
3% . UO<sub>2</sub> laser  
가  
1J UO<sub>2</sub>, UO<sub>2</sub>-10wt%Gd<sub>2</sub>O<sub>3</sub>

### Abstract

Laser flash apparatus for the measurement of thermal diffusivity was installed at the advanced fuel science building, Korea Atomic Energy Research Institute (KAERI). This report presents the specification of the instrument and some experimental experiences. In order to verify the measurement accuracy, thermal diffusivity of the standard material, Pyroceram9606, was critically measured and compared with the certified diffusivity and other published data. The differences between the measured and certified thermal diffusivities did not exceeded 3% in the whole measured temperature range. The thermal diffusivity values of UO<sub>2</sub> sample were measured at 100 with changing the laser pulse energy. The thermal diffusivities of UO<sub>2</sub> were linearly decreased with increasing of the laser energy. We fixed the laser energy to 1J and measured the thermal diffusivity of UO<sub>2</sub> and UO<sub>2</sub>-Gd<sub>2</sub>O<sub>3</sub>. The measured results were in good agreement with published data.

1.

plate [1] transient line source technique[2], laser-flash [3] guarded hot

laser-flash

. Laser-flash 1500 가

가

laser-flash

. Laser-flash

( )

( )

가

$$\kappa = \alpha C_p \rho$$

(1)

$C_p$

calorimetry (DSC)

differential scanning dilatometer

1500

laser-flash

가

## 2. Laser-flash

1

. Disc

가

laser

가

. Laser가

. Laser

가

$t$

2

[3].

$L$

$$\alpha = 0.139 \frac{L^2}{t_{1/2}}$$

(2)

laser

가

[4,5,6].

LFA427 . 가 가 laser pulse  
laser 가 가  
가 . 1

### 3. (Pyroceram9606) 가

POCO graphite, pyroceram9606, SRM1462 stainless steel  
Pyroceram9606  
[7]. European Commission  
6 pyroceram9606  
[8,9], IRMM (Institute of Reference Materials and Measurements,  
Belgium) (<http://www.irmm.jrc.be/>).

가  
Pyroceram9606  
National Physical Laboratory (NPL, U.K.)  
[10]. 12mm, 1-4mm ,  
colloidal graphite 10 $\mu$ m , 10<sup>-5</sup>mbar  
, detector laser  
NPL

Pyroceram9606 가 . Netzsch  
12.5mm, 2.5mm disc 가 pyroceram9606  
laser beam 15 $\mu$ m  
가 graphite . laser 1J  
500 50 . Ar  
100cc 3

2.

가

[7,9,10,11].

#### 4. $UO_2$ $UO_2-Gd_2O_3$

가 static property

가 laser - flash

laser beam 가

thermocouple

laser

$UO_2$

laser

10mm,

가 1mm

가

$10.4g/cm^3$

$UO_2$

graphite

1J, 2J, 3.5J

가

laser

beam

100

3 100

, laser

$UO_2$

가 가

. Laser

가  $UO_2$

1J

4K

가

. 3.5J

14K

.  $UO_2$

3

가 3.5J

가 1J

5%

5%

1J

laser

1J

3

가 0J

1J

2%

4. UO<sub>2</sub> 95%TD  
 [12,13,14] INSC(International Nuclear Safety Center)  
 UO<sub>2</sub> INSC 5%  
 INSC data base

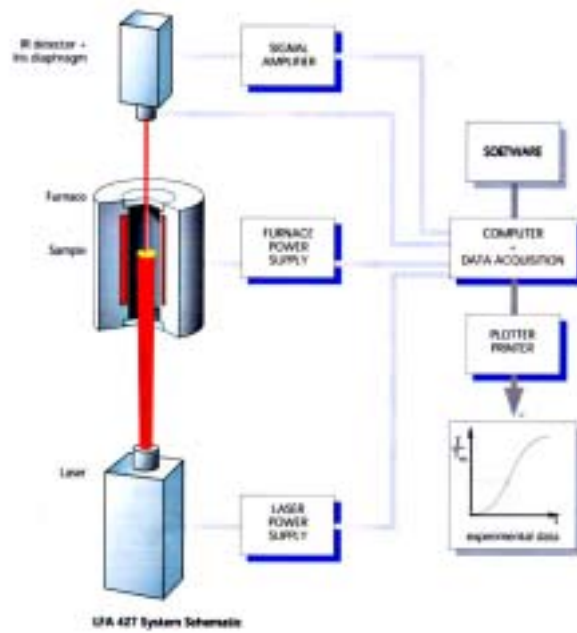
5. UO<sub>2</sub> 10wt% Gd<sub>2</sub>O<sub>3</sub>가 Gd<sub>2</sub>O<sub>3</sub>가  
 UO<sub>2</sub> 5  
 [13]

5.

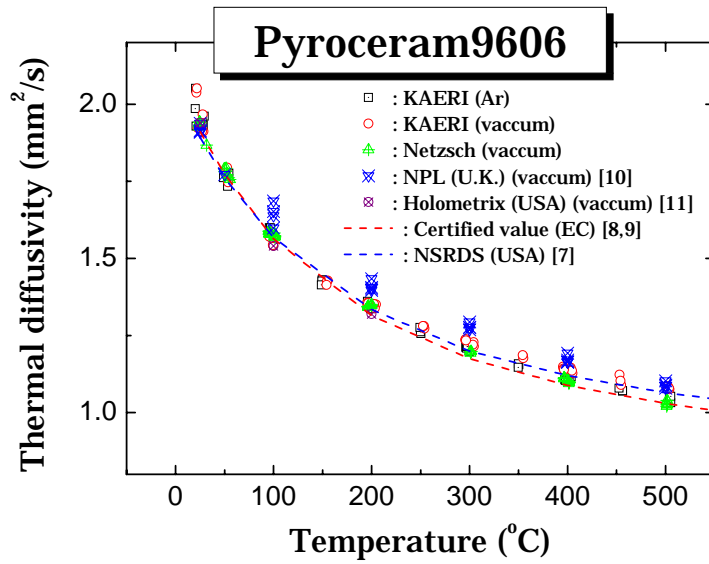
laser - flash  
 가 Pyroceram9606  
 3% UO<sub>2</sub>  
 laser 가 laser  
 1J UO<sub>2</sub> UO<sub>2</sub>-Gd<sub>2</sub>O<sub>3</sub>

1.

Temperature range	RT to 2000
Diffusivity range	0.001 to 10cm <sup>2</sup> /s
Atmosphere	Oxidizing, Slightly reducing, Inert and Vacuum (static/dynamic)
Sample dimension	1 to 6mm thick 6,10,12.5mm diameter
Laser input power	1 -20J

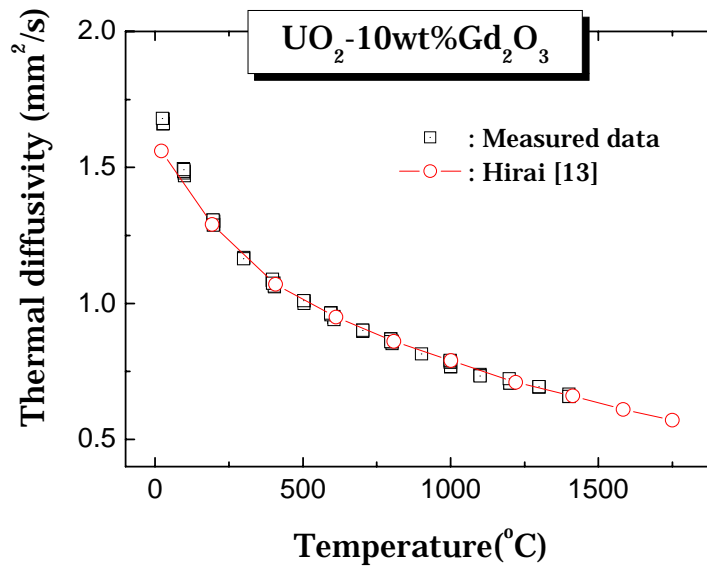


1.



2. Pyroceram9609





5. UO<sub>2</sub>-10wt%Gd<sub>2</sub>O<sub>3</sub>

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- [13] M. Hirai, J. Nucl. Mat., 173 (1990) 247.
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