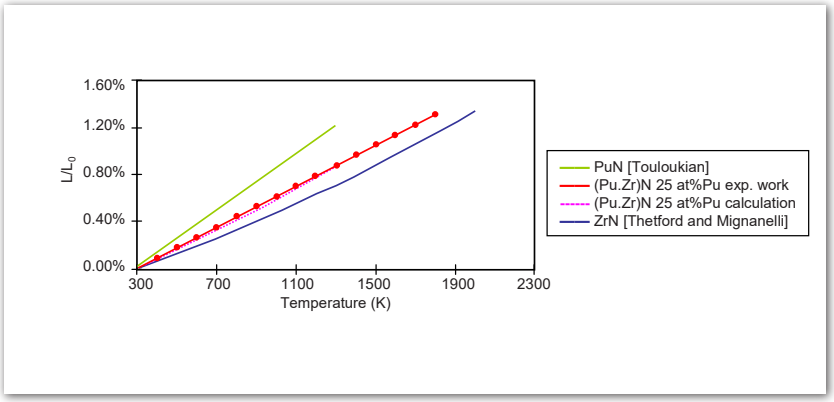
Linear thermal expansion of $(Pu_{0.25},Zr_{0.25})N$ pellets

INTRODUCTION

For the purpose of burning americium and degraded plutonium, implementation of accelerator driven systems (ADS) may enable a significant reduction of the radio-toxic inventories directed to geological repository. However, nitride fuels allow irradiation up to high burnup without degradation of safety margins or reprocessability. Therefore, in order to predict the in pile behaviour of nitride fuels, the thermophysical properties of plutonium-zirconium nitride (0-25at.% Pu), in particular the density, were measured on pellets.

EXPERIMENT

To calculate the density with temperature, the linear thermal expansion coefficient data (Δ/L_0) can be determined experimentally from a THEMYS TMA. Then, density versus temperature can be calculated as $\rho=\rho_0/(1+\Delta/L_0)^3$ where the subscript 0 refer to the room temperature.



Temperature dependence of thermal expansion of $(Pu_{0.25}Zr_{0.75})N$

RESULTS AND CONCLUSION

The experimental results bring out that the variation of the thermal expansion of $(Pu_{0.25},Zr_{0.75})N$ versus temperature was almost linear up to 1800 K, leading to a constant value of the linear thermal expansion coefficient of about $8.7–8.8.10^{-6}K^{-1}$. Moreover, we can note that the measurements were in good agreement with the values calculated from PuN and ZrN available data according to the following mixing law:

$\Delta L/L_0((Pu_x, Zr_{(1-x)})N) = v.\Delta/L_0 (PuN) + (1-v) L/L_0(ZrN)$

where v is the volume fraction of PuN in the solid solution.

INSTRUMENT

THEMYS TMA

PRESERVATION OF SAMPLES
due to low load vertical TMA system.

ULTRA-HIGH TEMPERATURE CAPABILITY
to 2400°C with a single furnace.

MODULAR ADAPTIONS ALLOWING
TGA only, DTA only, TG-DTA, and TMA up to 2400°C, DSC only and TG-DSC up to 1600°C all in one instrument.

EXTERNAL COUPLING CAPABILITY
designed for evolved gas analyzers (FTIR, MS, GCMS, MSFTIR, or FTIR-GCMS)