

# Development of Security and Safety Fuel for Pu-burner HTGR

## (17) Numerical Study on the Transient Oxidation of Nuclear Graphite under Air Ingress Conditions

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**Abstract** In this study, a graphite oxidation model was incorporated into a system analysis code called RELAP5/SCDAP. The code was then validated against experiments to demonstrate its applicability on modeling graphite oxidation during an event of air ingress.

**Keywords:** HTGR, Air ingress accident, Graphite oxidation, Numerical study, RELAP5/SCDAP

### 1. Introduction

Graphite oxidation which occurs during air ingress could largely jeopardized the safety operation of HTGR. To improve the HTGR safety analysis during such accident, graphite oxidation model was improved and incorporated into REALP5/SCDAP. Validation of the improved code were carried out by comparing to a validation experiment.

### 2. RELA5/SCDAP code modification

RELAP5/SCDAP code was improved to support the analysis of air ingress accident in HTGR. The improvements include, first, a chemical equilibrium graphite oxidation model (of IG-110) and a CO combustion model were incorporated into the code; Second, the thermodynamic and transport properties of O<sub>2</sub>, CO and CO<sub>2</sub> were added to the code to support the HTGR severe accident analysis.

### 3. Results and Conclusions

Fig.1 and Fig.2 show the comparison between the simulation and measurement of temperature transient and weight loss during graphite oxidation. Inspection of the figures shows that, the improved RELAP5/SCDAP can predict the general trend of graphite temperature during oxidation. The accuracy of the code was estimated by comparing the simulation to the measured graphite weight loss data of which the error ranges from 6.3%~20.7%. In general, the code tends to slightly over predicts graphite oxidation rate and hence RELAP5 would give conservative prediction on HTGR air ingress.

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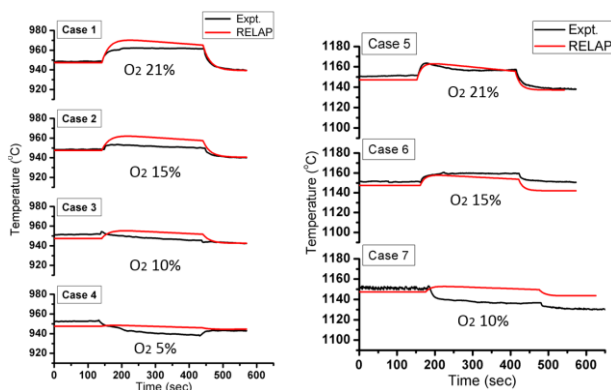


Figure 1 Comparison of the code simulated and experimental measured graphite temperature

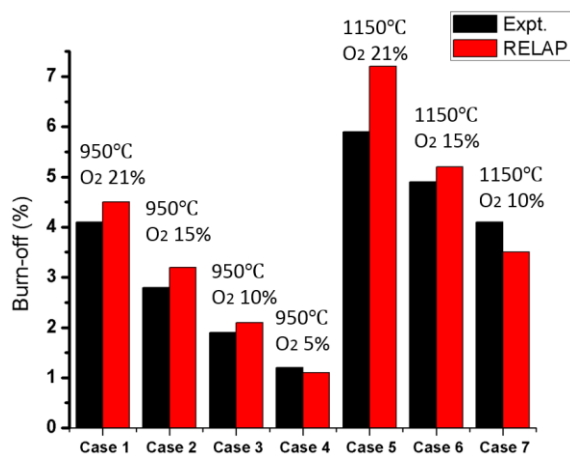


Figure 2 Comparison of the code simulated and experimental measured graphite weight loss