Preliminary Analysis of Transport and Storage Cask under 9 m Side Drop Condition

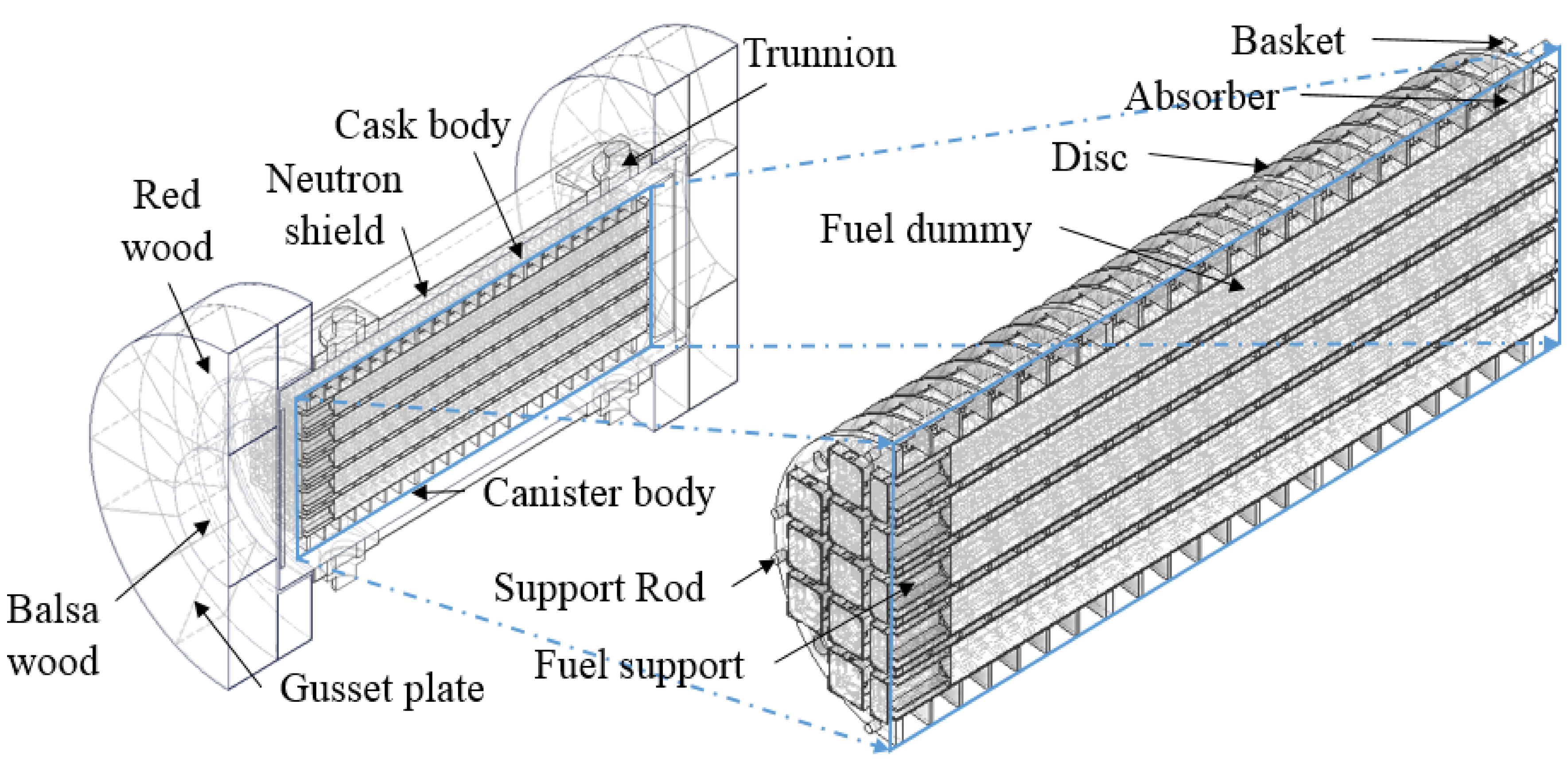
Hyun-Gon Kim, Dong-Hyun Kim, Tae-Jin Kim and Yoon-Suk Chang
Department of Nuclear Engineering, Kyung Hee University

Introduction

- Integrity of **transport and storage cask** should be maintained under 9 m drop accident according to the Nuclear Safety and Security Commission regulation
- **9m side drop analysis** was conducted by using commercial software ANSYS
- Maximum primary membrane stress intensity (P_m) and primary bending stress intensity (P_b) were examined
- **Critical locations** of each component were determined
- **Stress intensity** distributions of the cask and fuel assembly were depicted

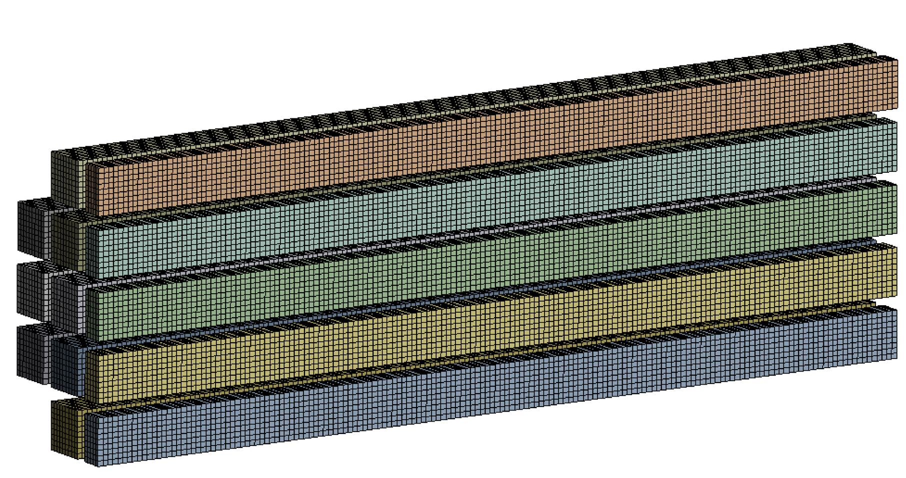
Analysis Model & Conditions

Transport and storage cask model

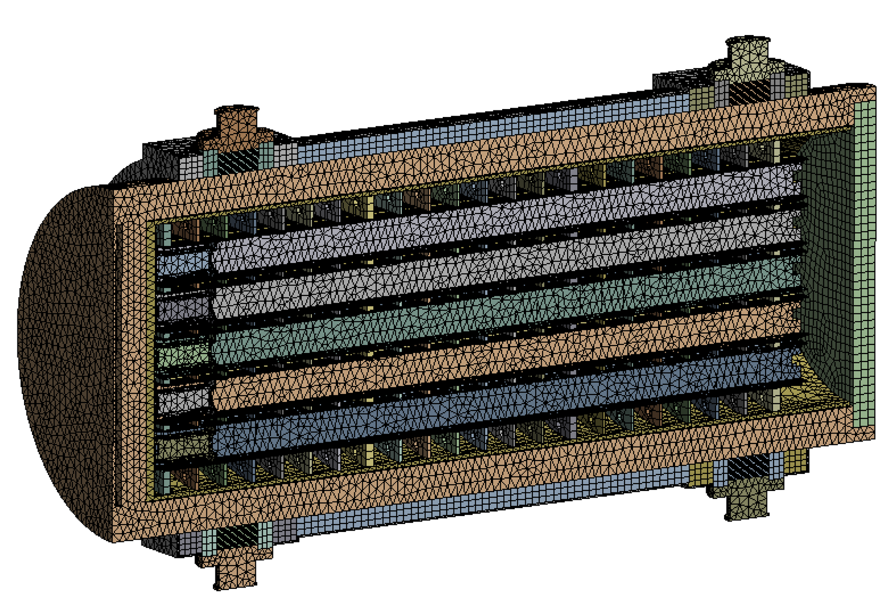


▲ Schematics of transport and storage cask

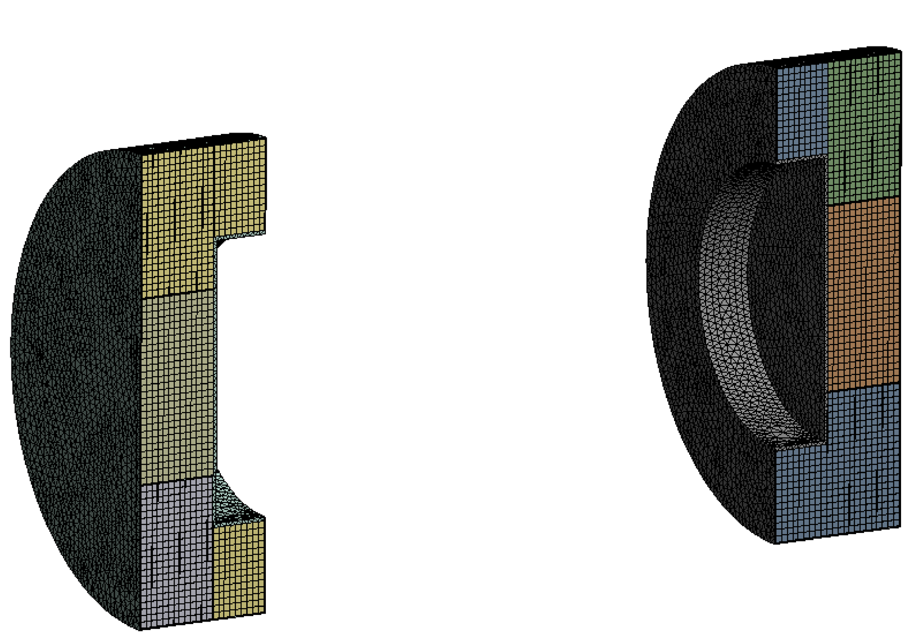
FE model



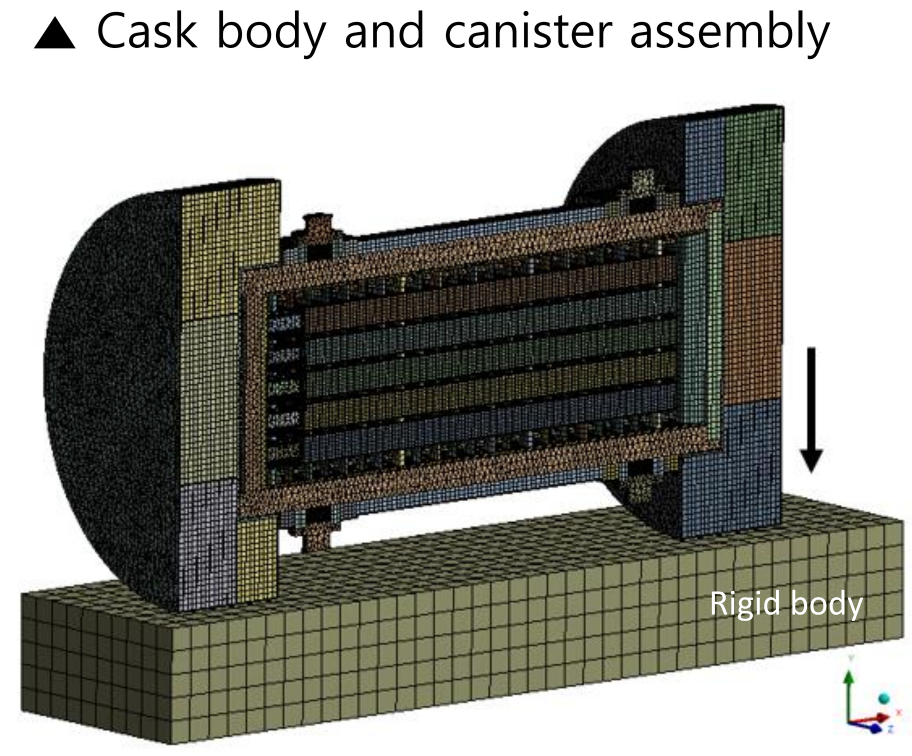
▲ Fuel assembly



▲ Cask body and canister assembly



▲ Impact limiter



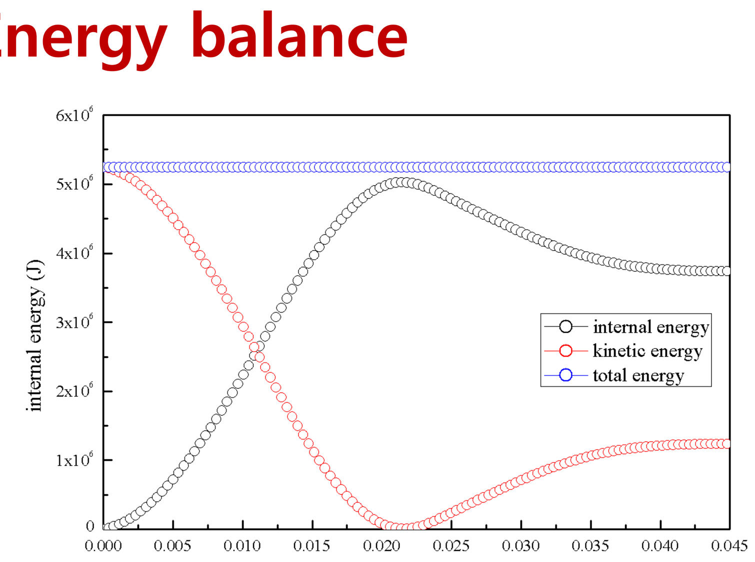
▲ Transport and storage cask

Mesh info. & Boundary conditions

- Number of nodes : 504,036
- Number of elements : 634,638

- Gravity acceleration : 9.81 m/s^2
- Collision velocity : 13.29 m/s
- Frictional coefficient : 0.2
- Z-axis symmetry

Energy balance



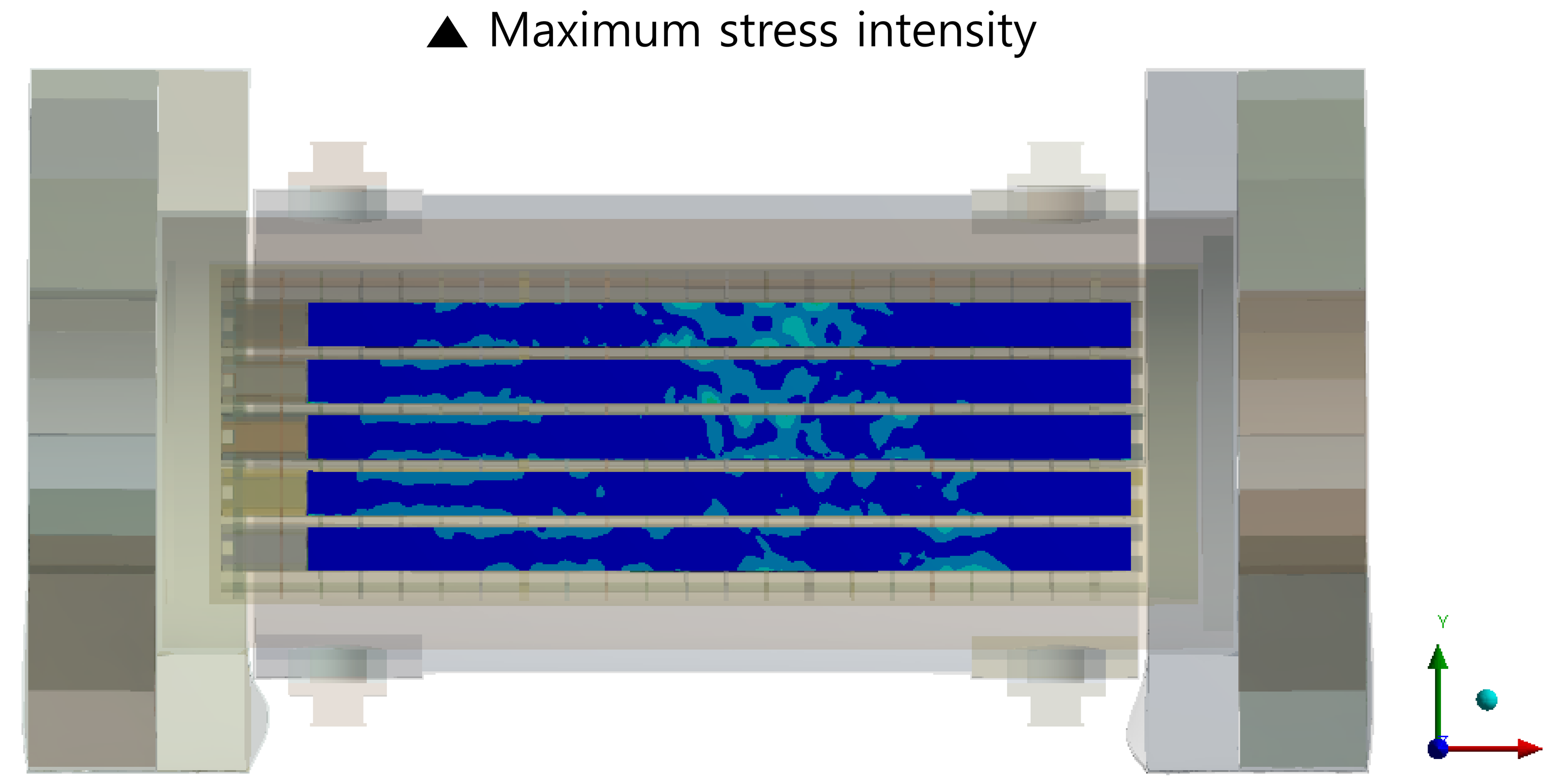
- Internal and kinetic energies were exchanged each other
- Total energy was maintained constantly

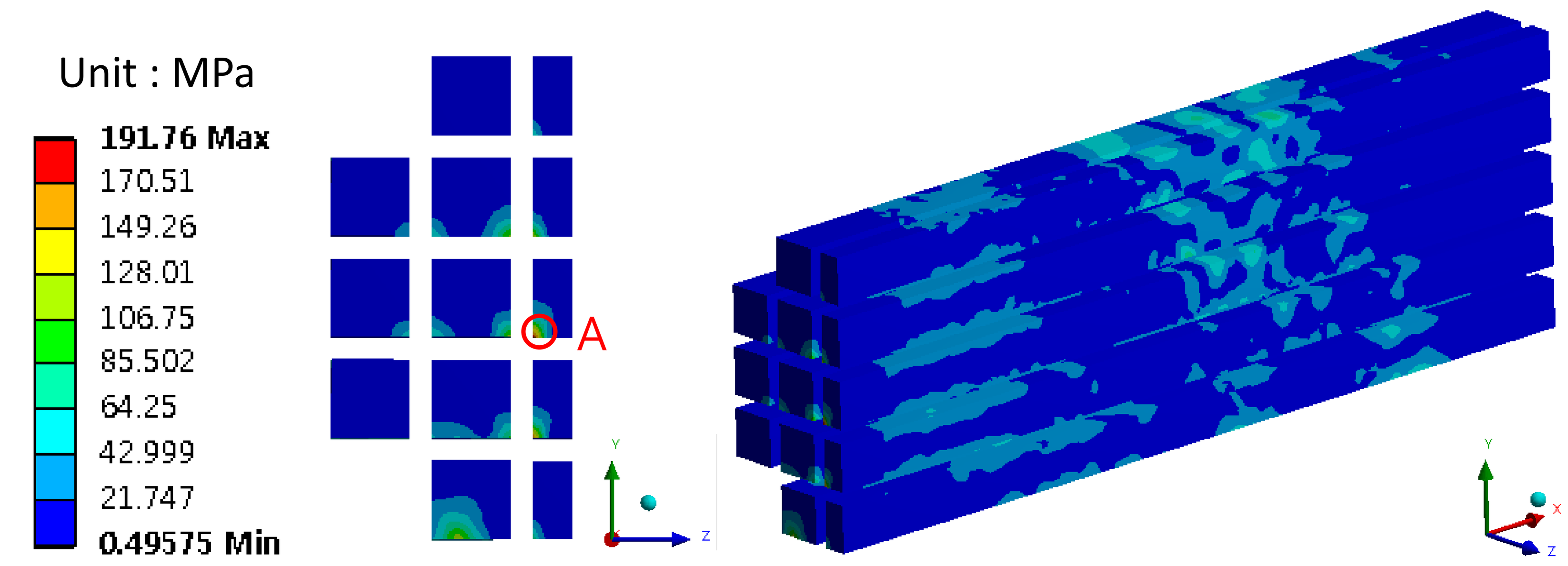
Analysis Results

Stress analysis

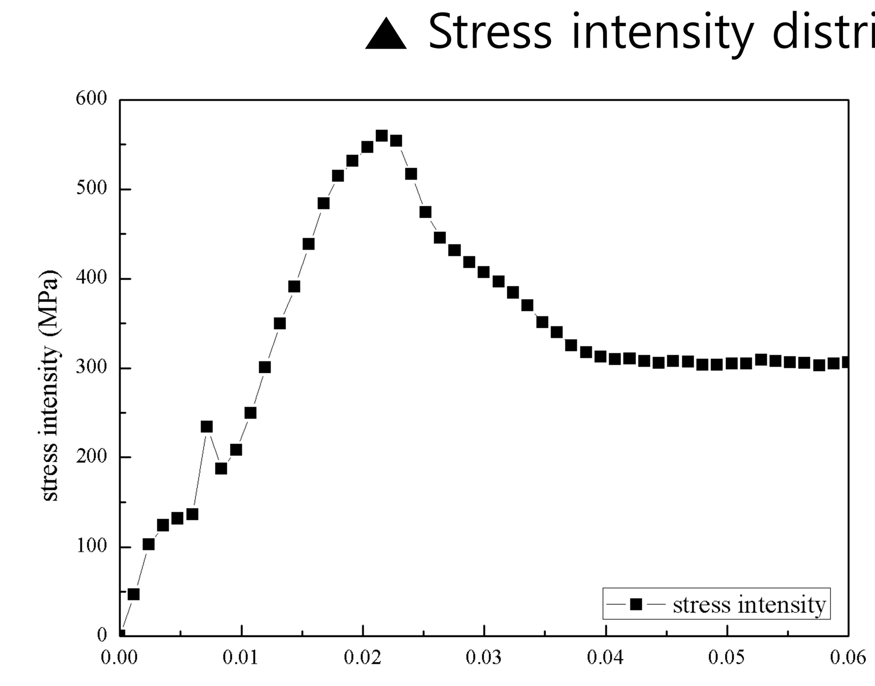
Components	Stress classification	Maximum stress intensity (MPa)	Allowable stress intensity (MPa)
Cask body	P_m	86	338
	$P_m + P_b$	216	483
Canister body	P_m	90	247
	$P_m + P_b$	130	371
Disc	P_m	45	428
	$P_m + P_b$	232	551
Fuel assembly (Dummy)	P_m	42	289
	$P_m + P_b$	87	413

▲ Maximum stress intensity

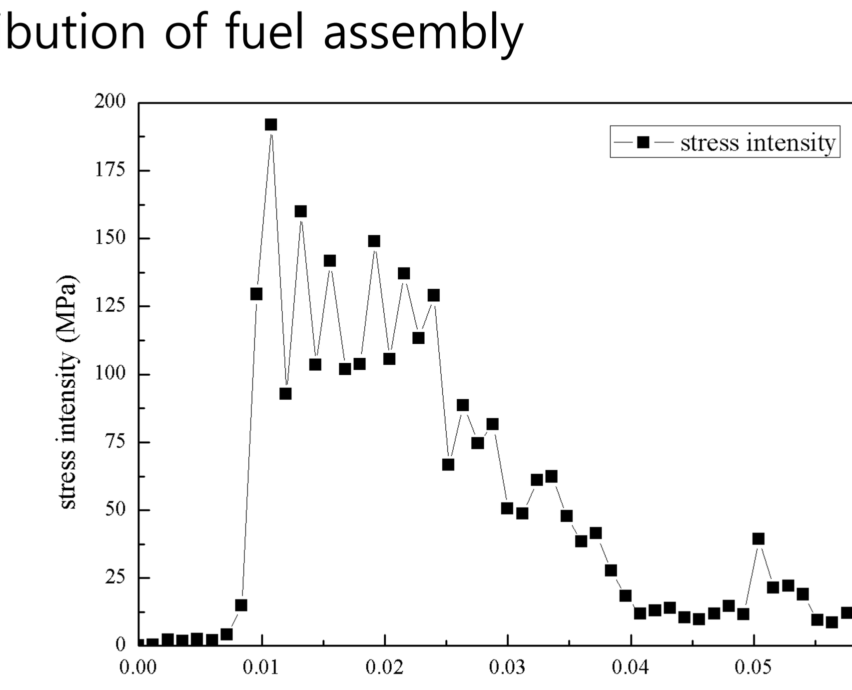




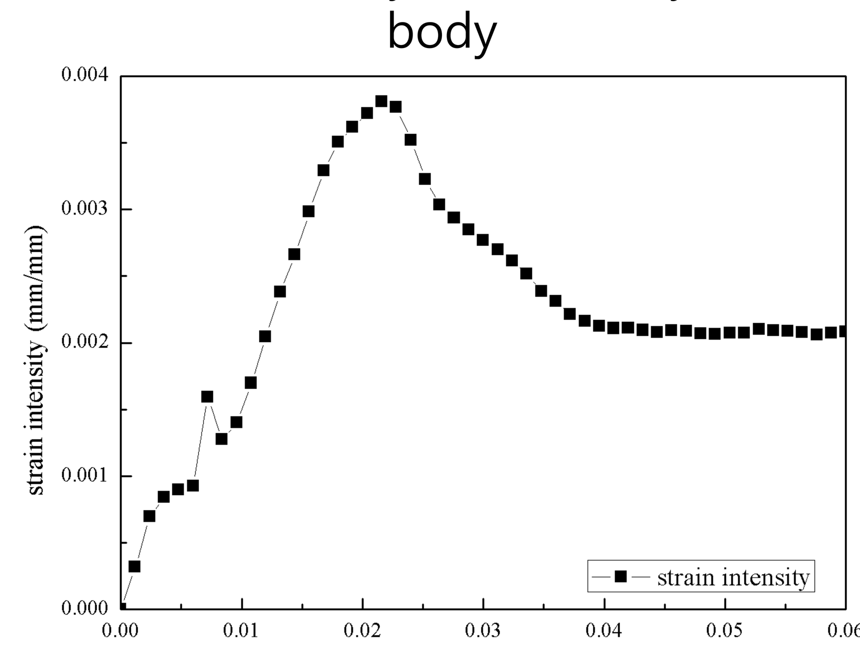
▲ Stress intensity distribution of fuel assembly



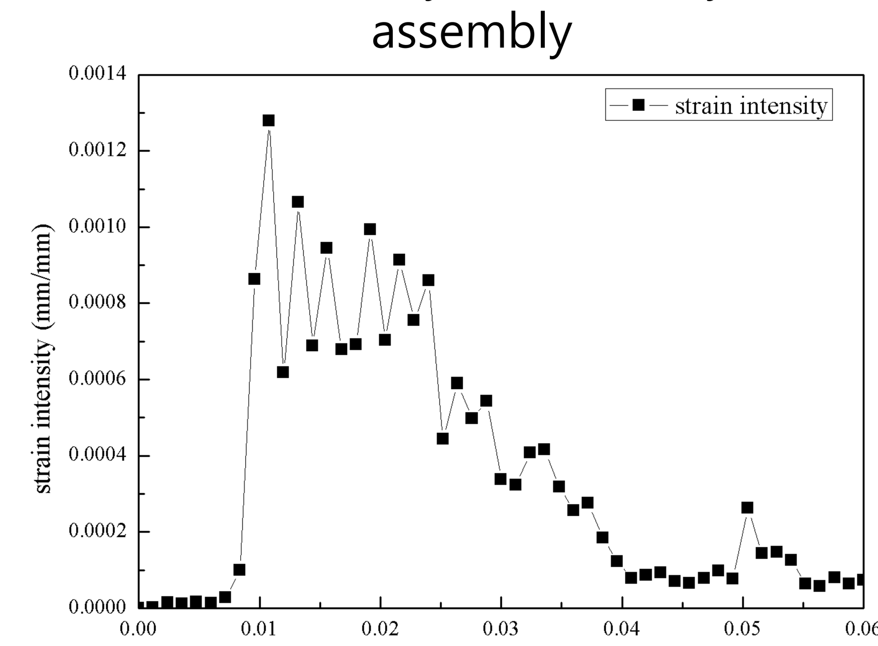
▲ Stress intensity time history of cask body



▲ Stress intensity time history of fuel assembly



▲ Strain intensity time history of cask body



▲ Strain intensity time history of fuel assembly

- Point A is a position where fuel assembly shows maximum stress intensity
- Maximum stress intensity of the fuel assembly was 191 MPa at 0.0108 s

Conclusions

- ½ FE model of transport and storage cask was constructed as full scale
- Maximum P_m and $P_m + P_b$ of each component were lower than corresponding allowable stress intensity values
- Parametric FE analysis will be conducted considering detailed model of fuel assembly