

Quantitative evaluation of response of LOVA gun propellant charge by bullet impact and cook-off

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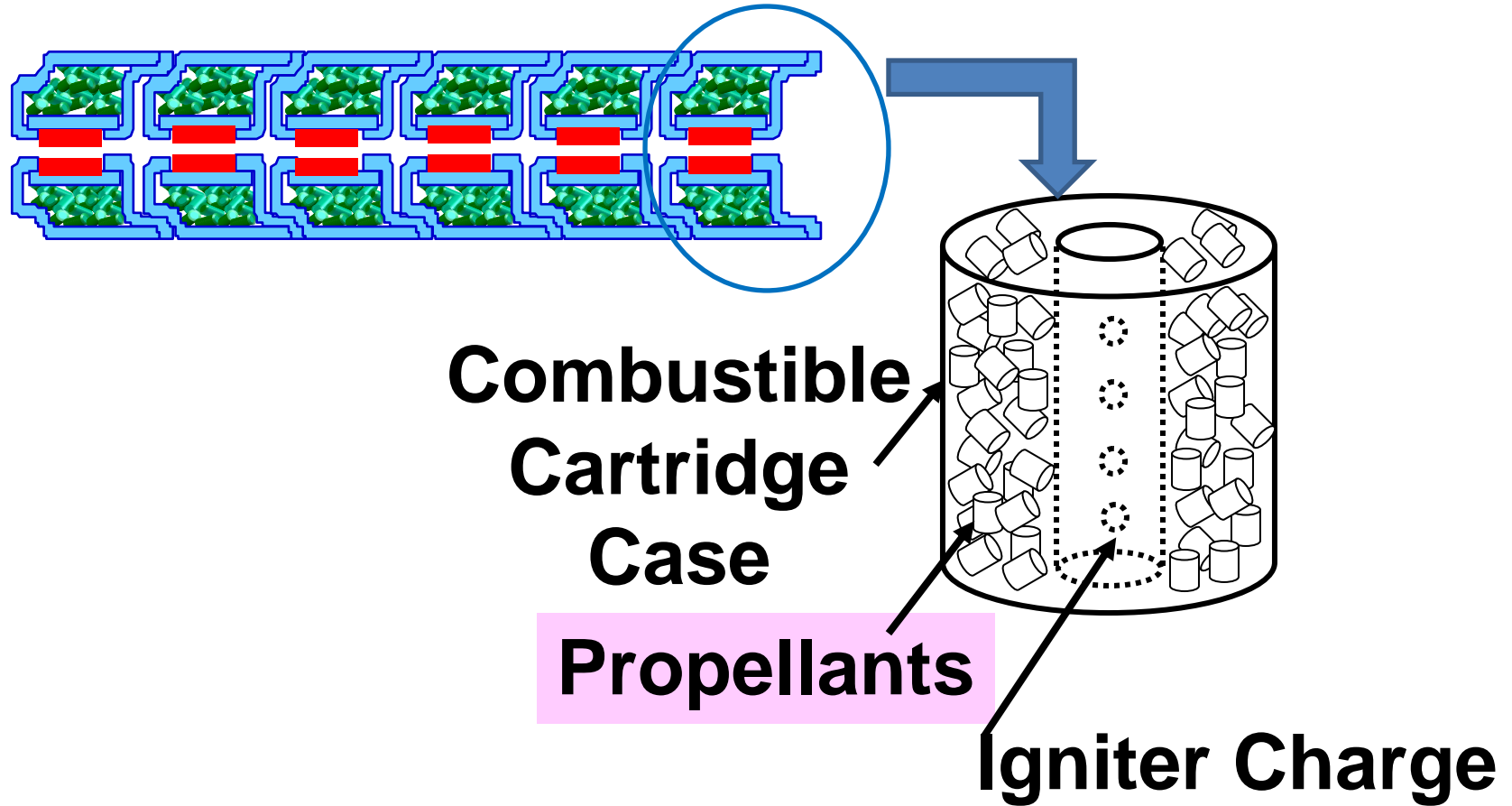
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Objectives

To obtain technical data of LOVA propellant charge about the following items

- 1. Composition of propellant to decrease the sensitivity to bullet impact and cook-off**
- 2. Estimation method of bullet impact and cook-off**

Test Sample (Cut-view of propellant Charge)



Test Sample (Composition of propellant)

Propellants			
	Binder	Energetics	Plasticizer
Ref	NC	NQ	NG
A	NC	RDX	DEGDN
B	NC CAB	RDX	DEGDN
C	CAN	RDX	BTTN
D	NC	RDX	BTTN
E	NC TPE	RDX	BDNPA/F

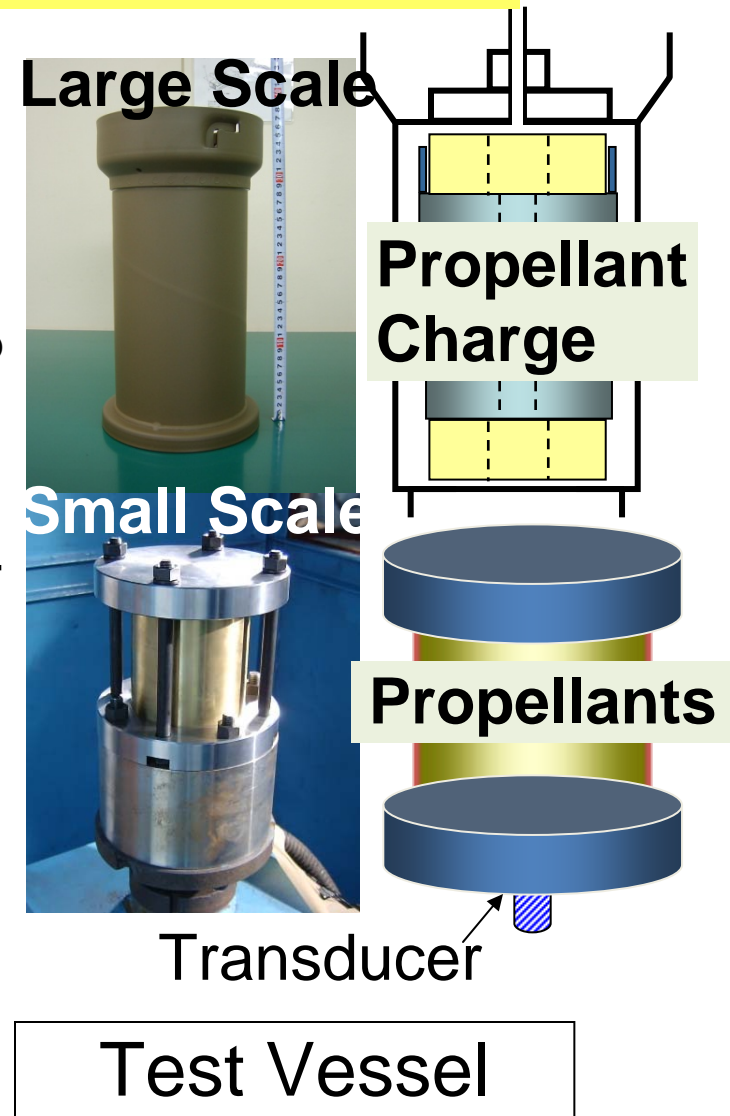
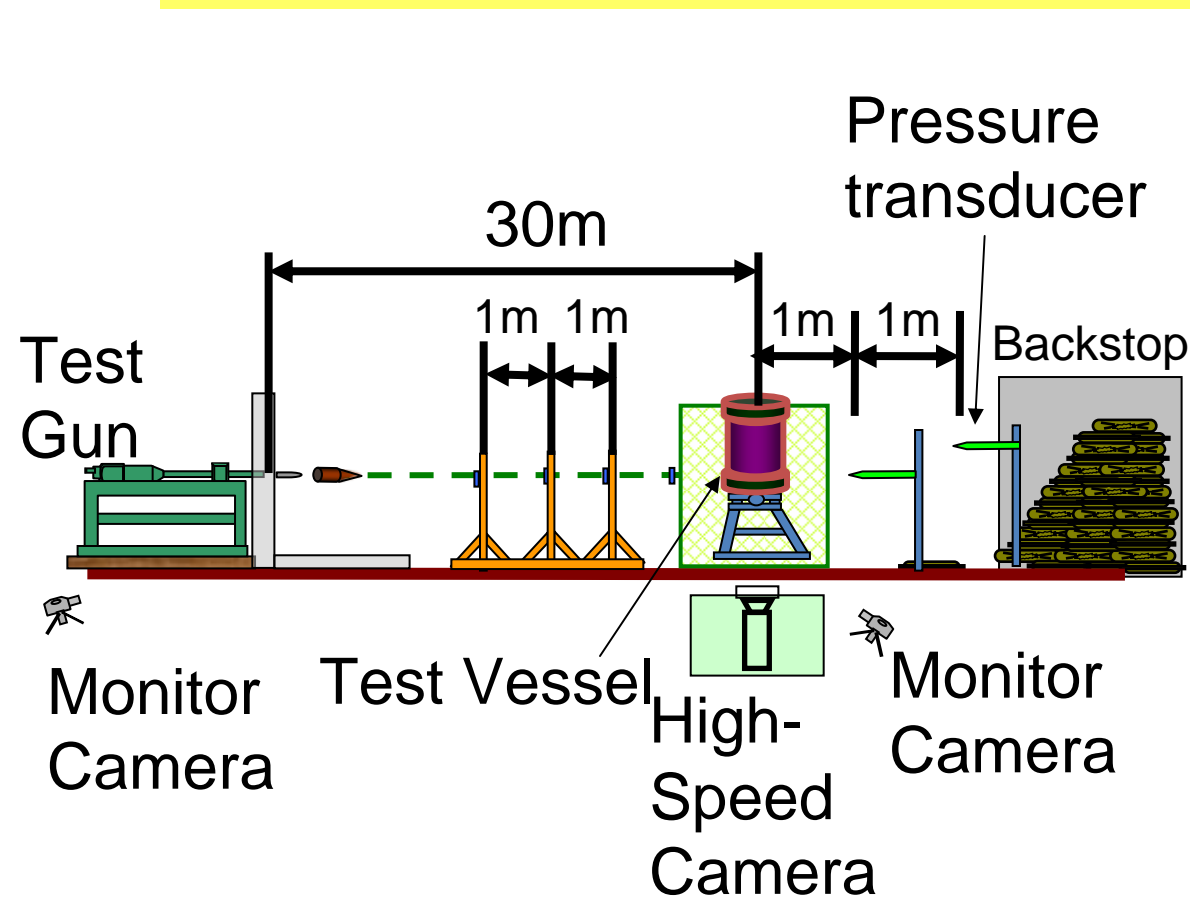
CAB □ Cellulose Acetate Butylate

CAN □ Cellulose Acetate Nitrate

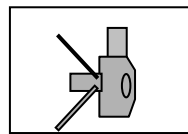
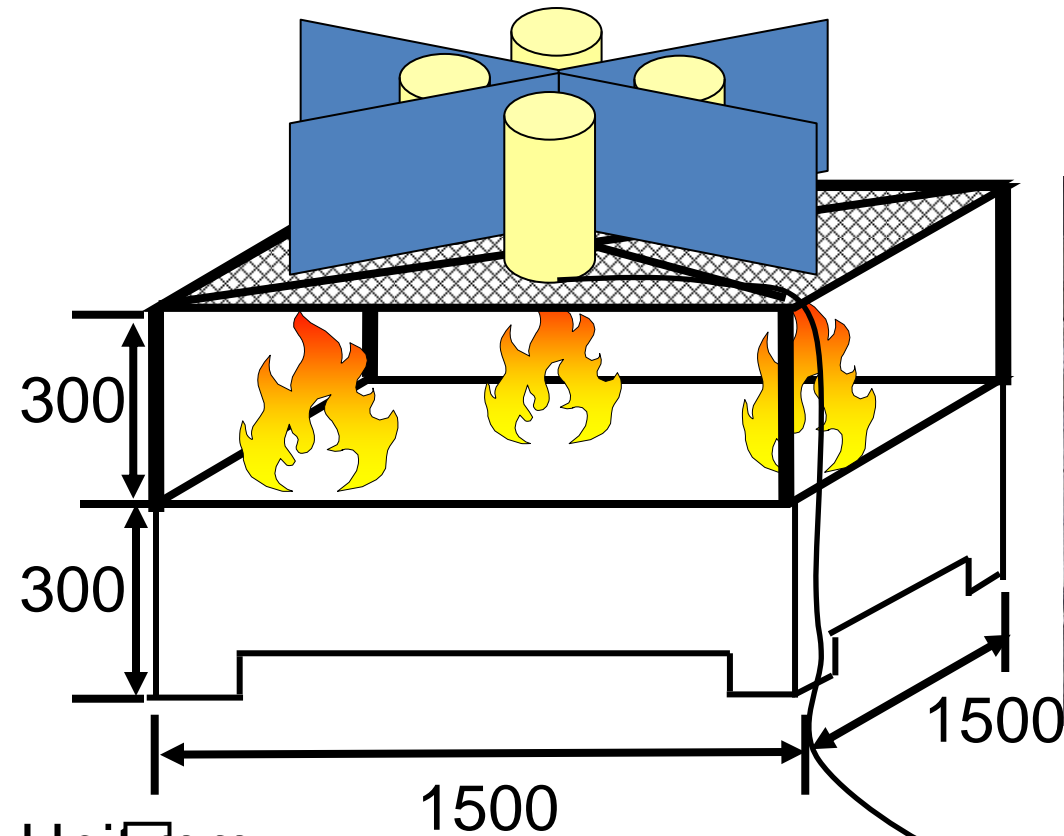
BTTN □ Butane Triol Tri Nitrate TPE □ Thermo Plastic Elastomer

BDNPA/F □ Bis-Di Nitro Propyl Acetal/Formal

Test Setup (Bullet Impact)



Test Setup (Fast Cook-Off Large Scale)

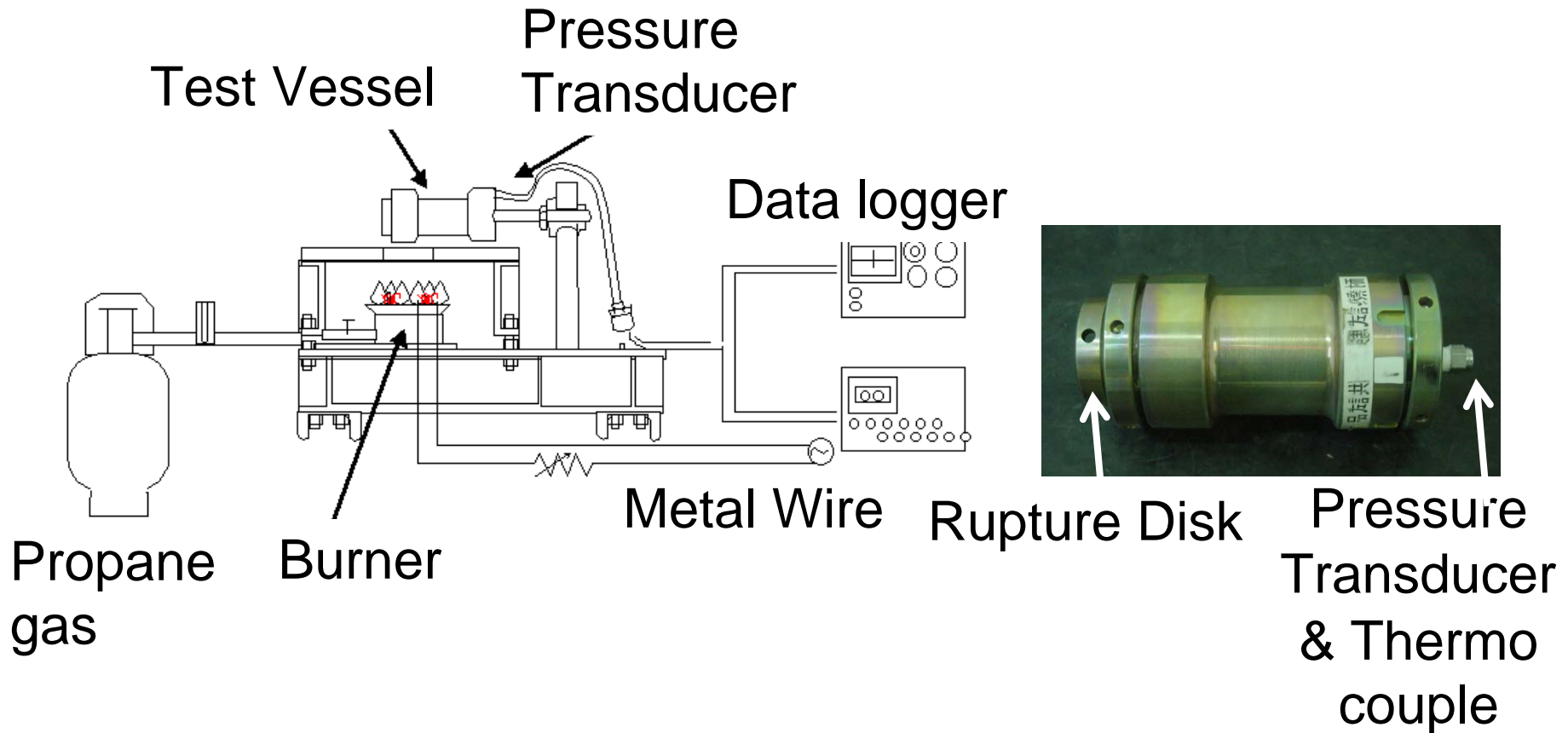


Monitor Camera

Thermo Couple

Flame Temp

Test Setup (Fast Cook-Off Small Scale)



Test Vessel

Cut-view of Thermal analysis and Shock sensitivity test

Thermal analysis:
DSC and microcalorimeter

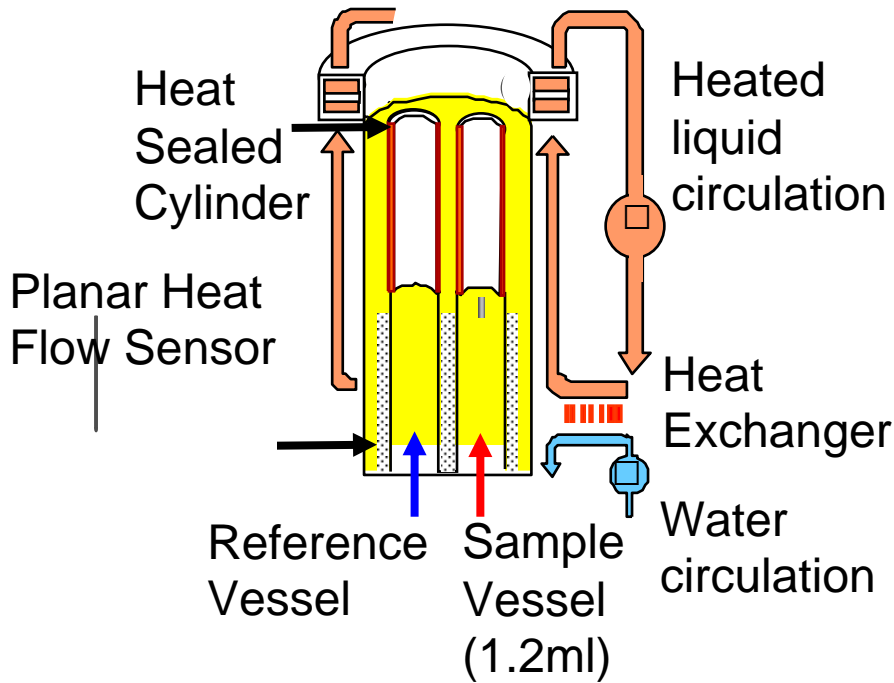


Figure of Reactor of microcalorimeter

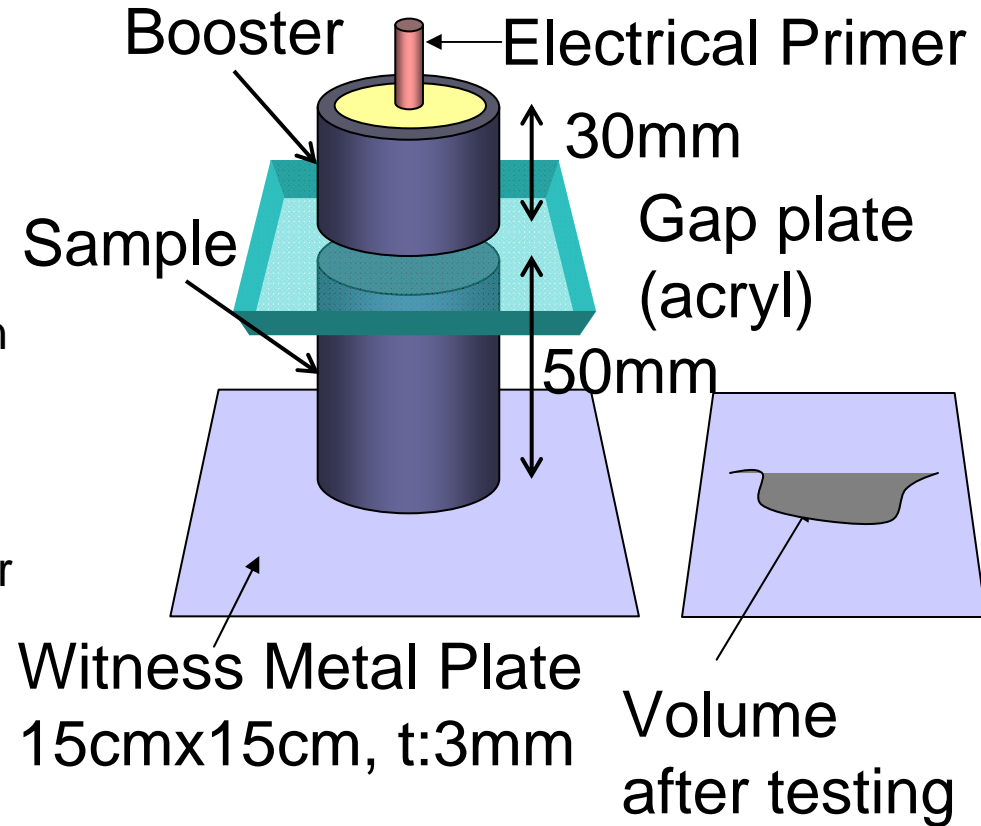
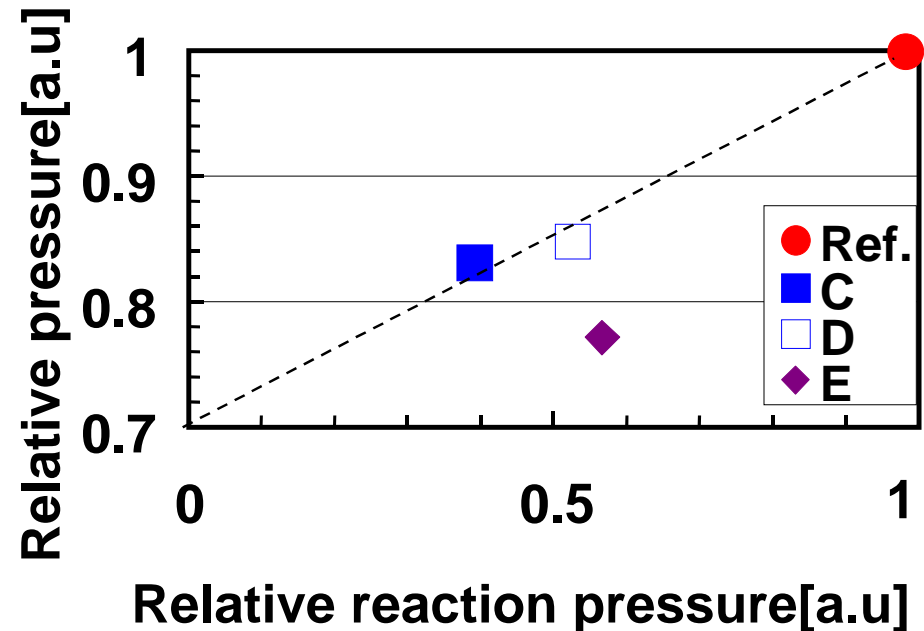
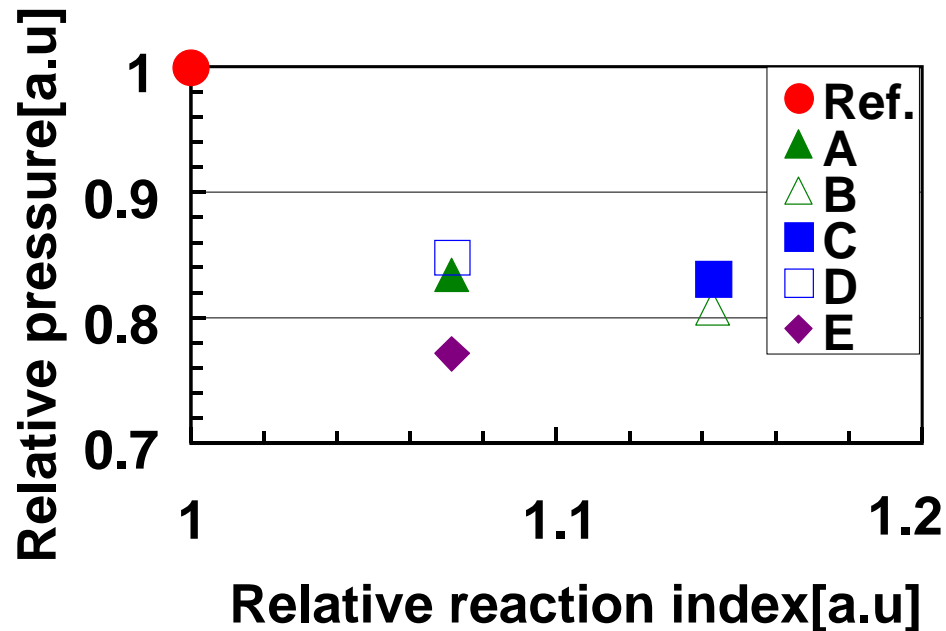


Figure of card gap test

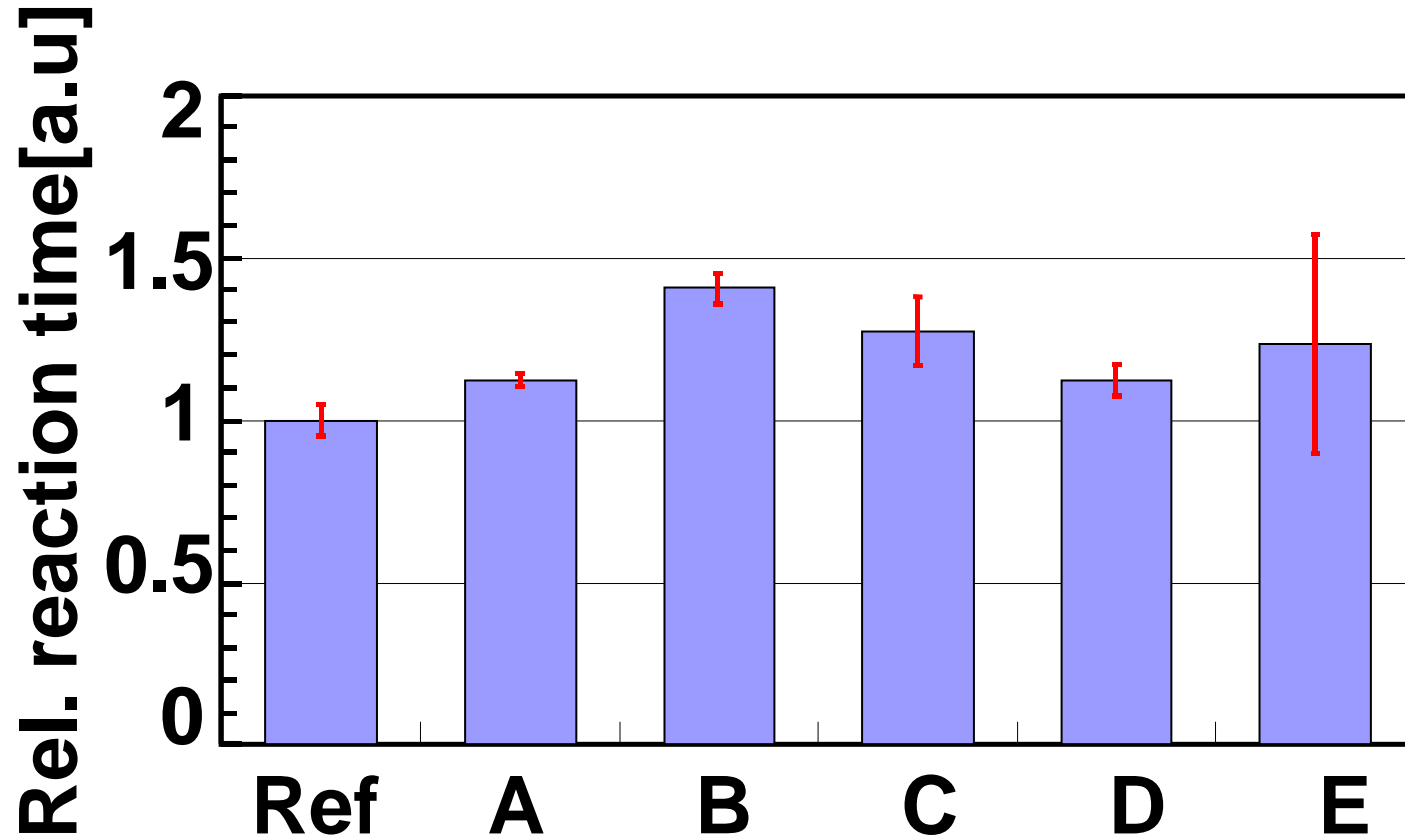
Correlation between static or reaction pressure and reaction index(MIL-STD)



* Static pressure and average reaction index of reference sample is equal to 1 as a relative value.

**New designed props show lower static pressure than ref.
Static pressure has correlation to reaction pressure.**

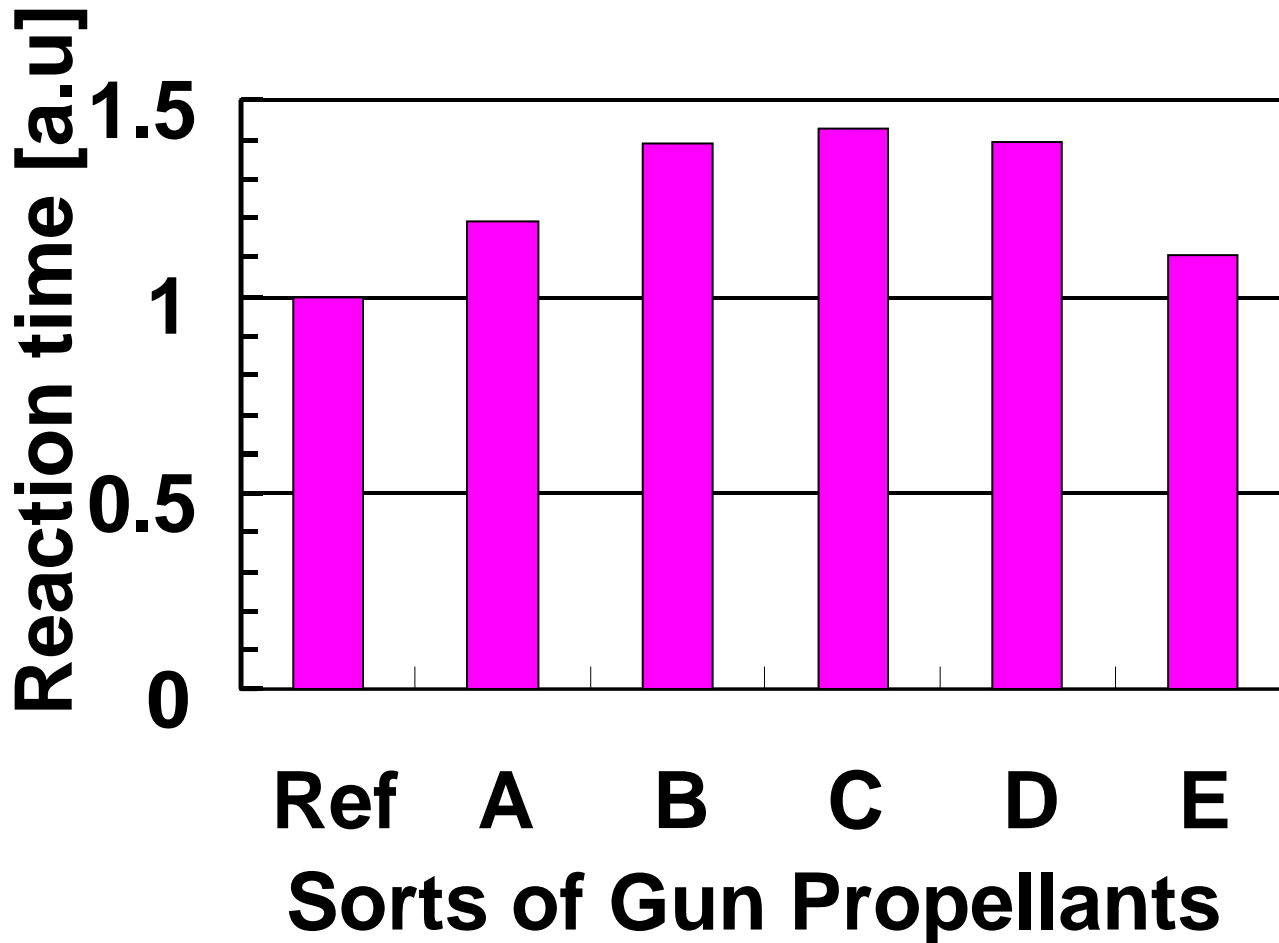
Comparison among compositions of propellants about large scale FCO



Sorts of Gun Propellant

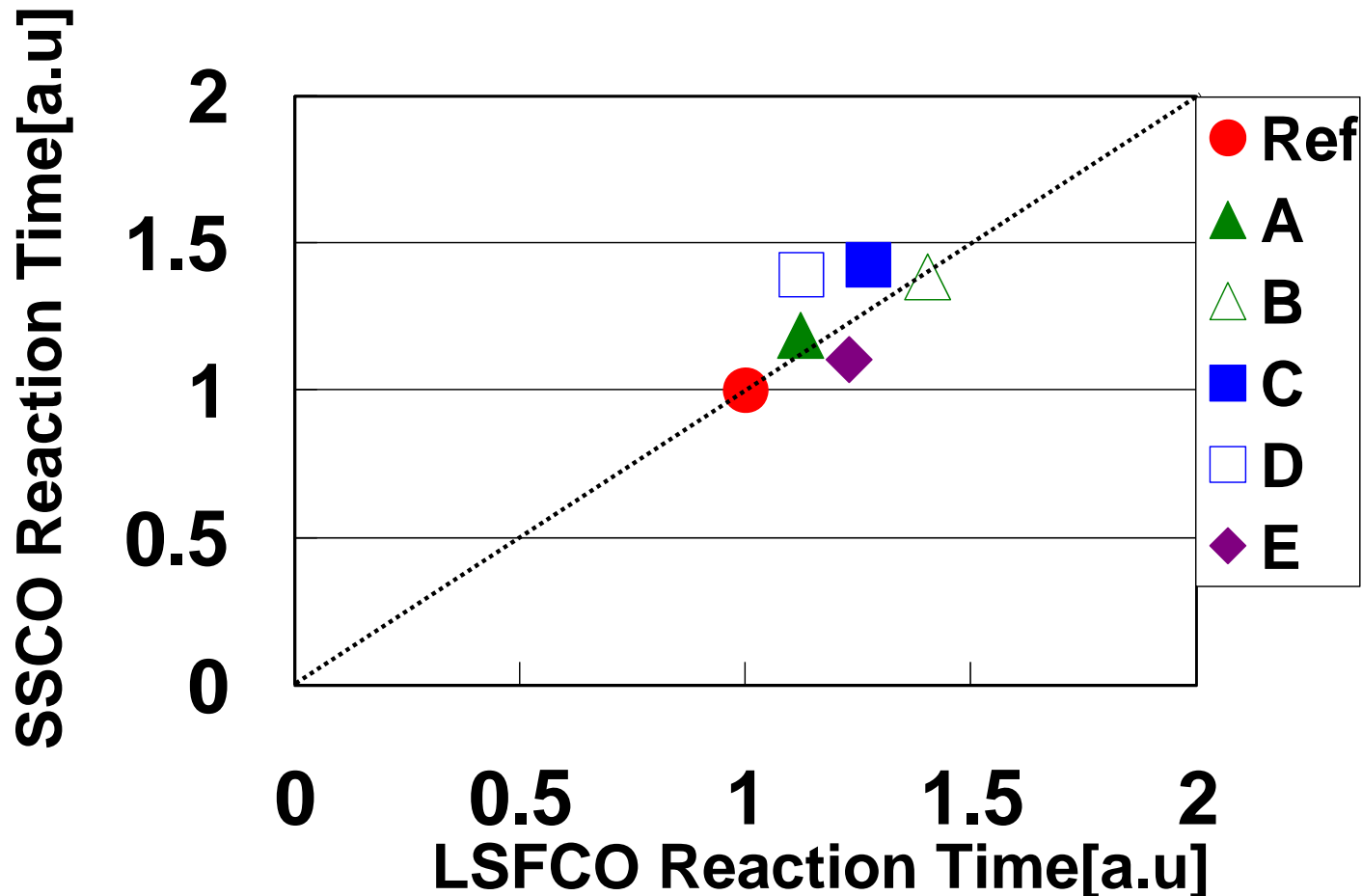
New designed props show longer reaction time than ref.
B type prop takes 40% longer time to reaction than ref.

Comparison among compositions of propellants about small scale FCO



New designed props show Lower static pressure than ref.
This result has same tendency as large scale FCO result.

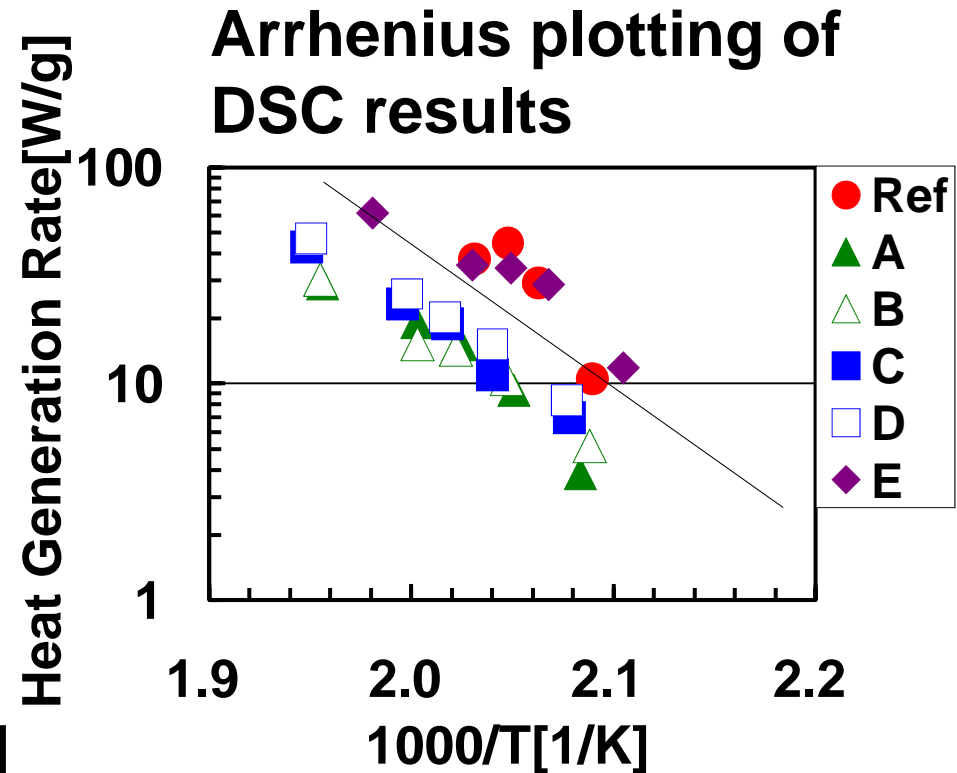
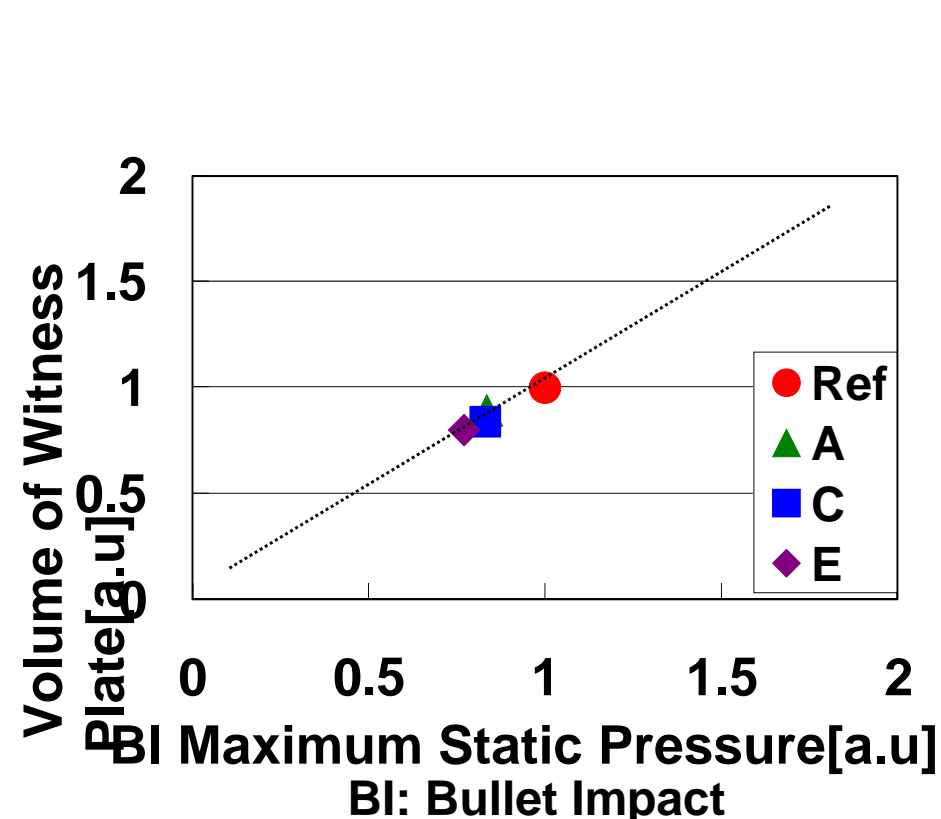
Correlation of FCO result between large scale and small scale



SSCO: Small Scale Cook Off LSFCO: Large Scale Fast Cook Off

LSFCO result shows linear correlation to SSCO result.

Comparison among compositions of propellants about BI and LSFCO



Shock sensitivity test results has correlation BI pressure

Thermal analysis results has same tendency as FCO results

→ These tests show estimation methods of BI and FCO

Conclusion

- 1. To confirm composition of propellant to decrease sensitivity to bullet impact and cook-off**
- 2. To estimation method of bullet impact and cook-off by correlation data between pressure or reaction time and the card gap test and thermal analysis.**