

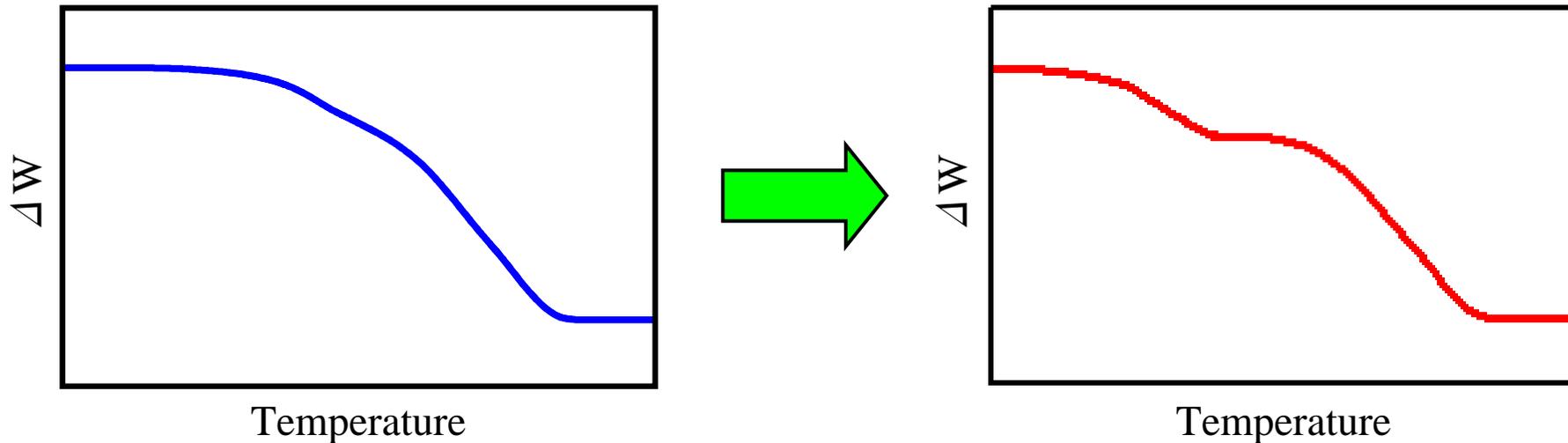


Separated Determination of
Carbon Black in Chloroprene Rubber
by
Simulation of Heating Rate Conversion

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SII NanoTechnology Inc.

Simulation of Heating Rate Conversion

< Conventional method >

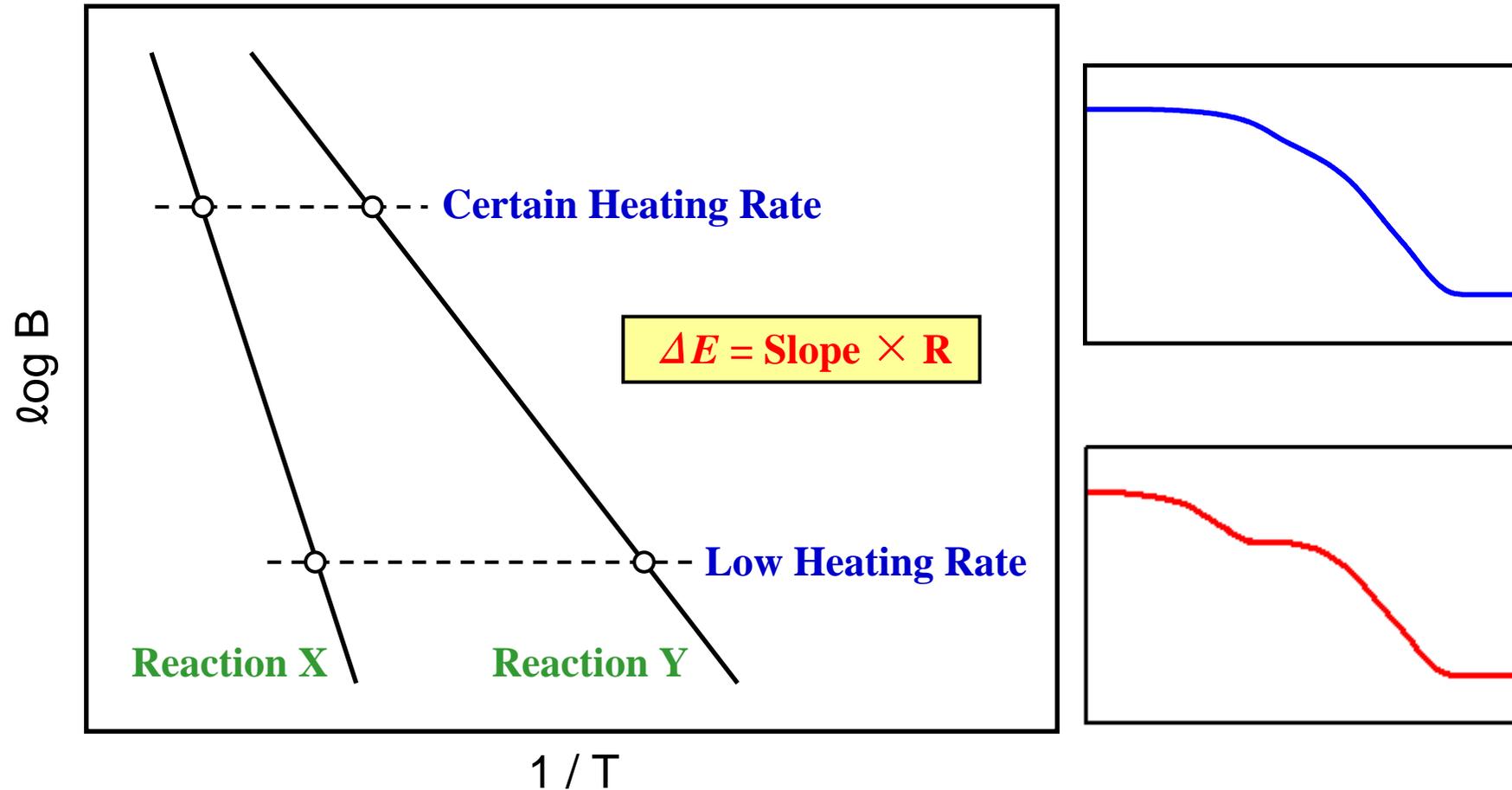


Low heating rate measurements

CRTA (Control-Rate Thermal Analysis)

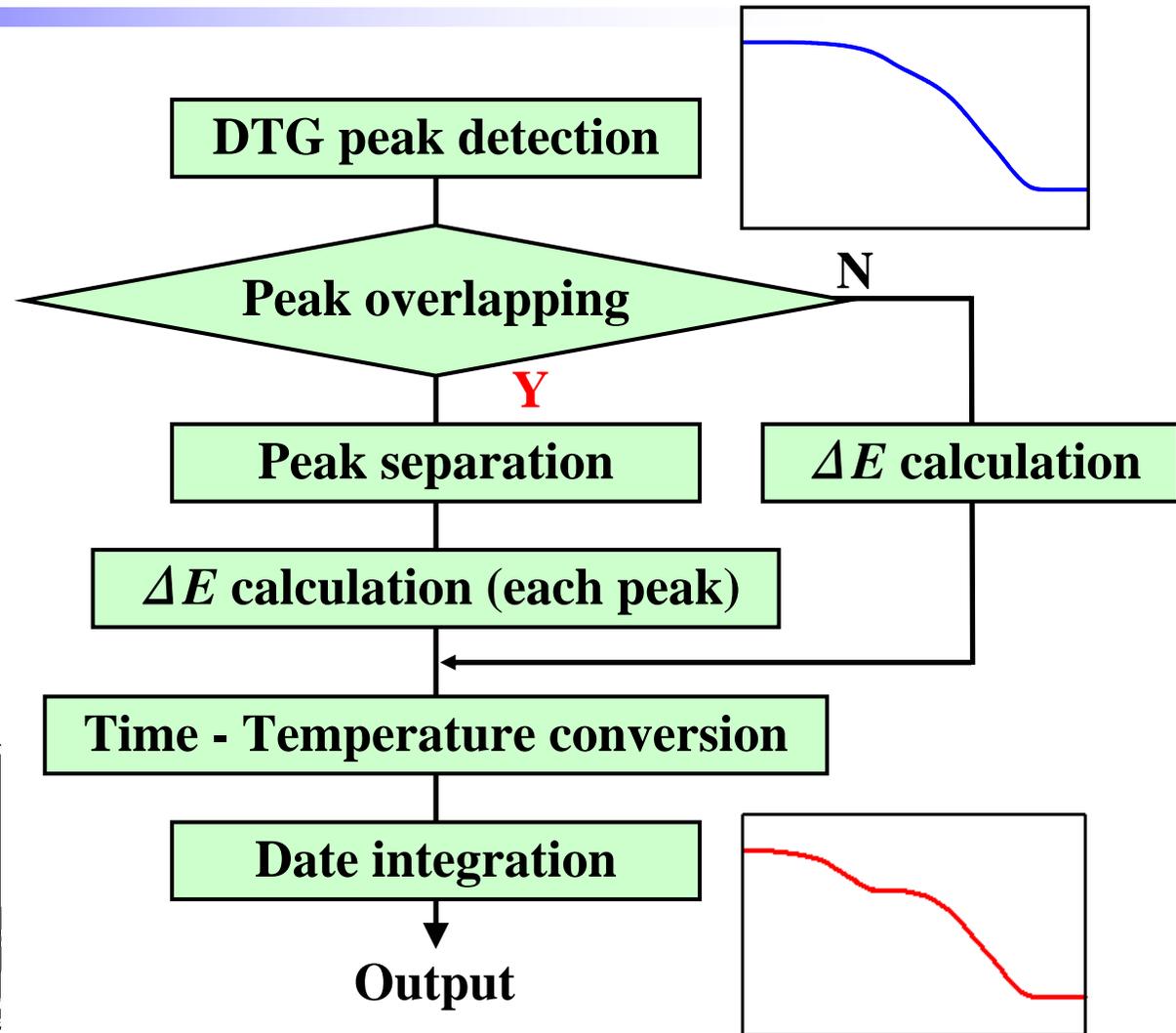
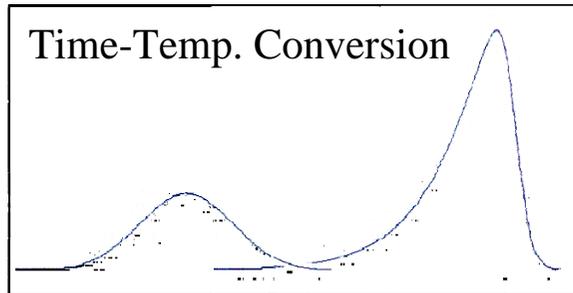
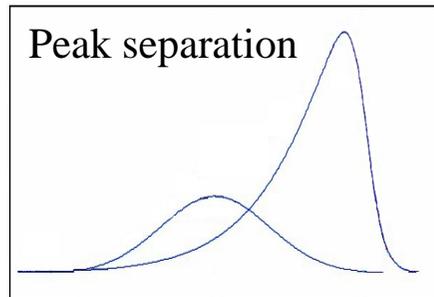
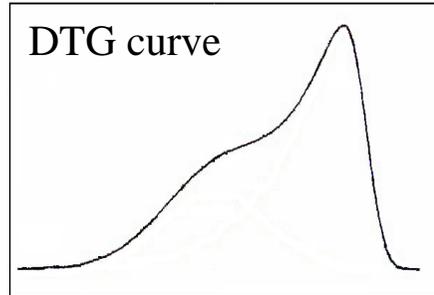
Simulation of Heating Rate Conversion

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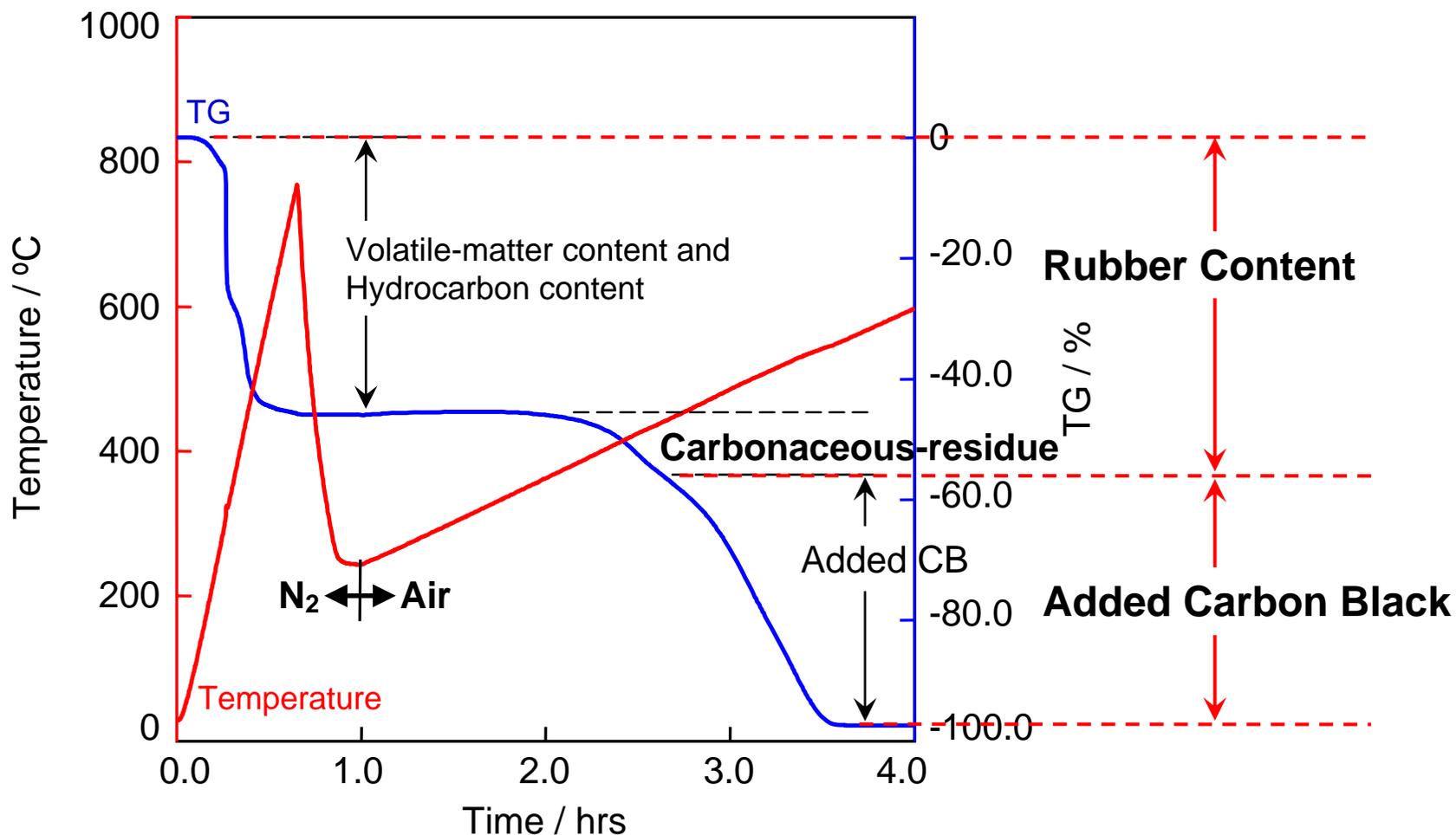
Arrhenius Plot for Multiple Reactions

Simulation of Heating Rate Conversion



Algorithm for Simulation of Heating Rate Conversion

Measurements Results



TG Measurement Results of Chloroprene Rubber

Sample : SRF70 (CB 37.4wt%)

Chloroprene Rubber Samples

Sample #	Carbon Black	Particle size (nm)	Compounding Ratio (phr)	CB content (wt%)
SAF50	SAF	18	50	29.6
HAF50	HAF	30	50	29.6
SRF10	SRF	65	10	7.8
SRF30			30	20.1
SRF50			50	29.6
SRF70			70	37.4
FT50	FT	150	50	29.6

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FT50	FT	150	50	29.6

Measurements



Instruments

TG/DTA6200 Thermogravimetry/Differential Thermal Analyzer



Temperature Range	RT ~ 1100°C
Balance System	Horizontal Differential Type
TG Range	±200mg
TG RMS Noise/Sensitivity	0.1µg/0.2µg
DTA RMS Noise/Sensitivity	0.03µV/0.06µV
Scanning Rate	0.01 ~ 100°C/min

Measurements



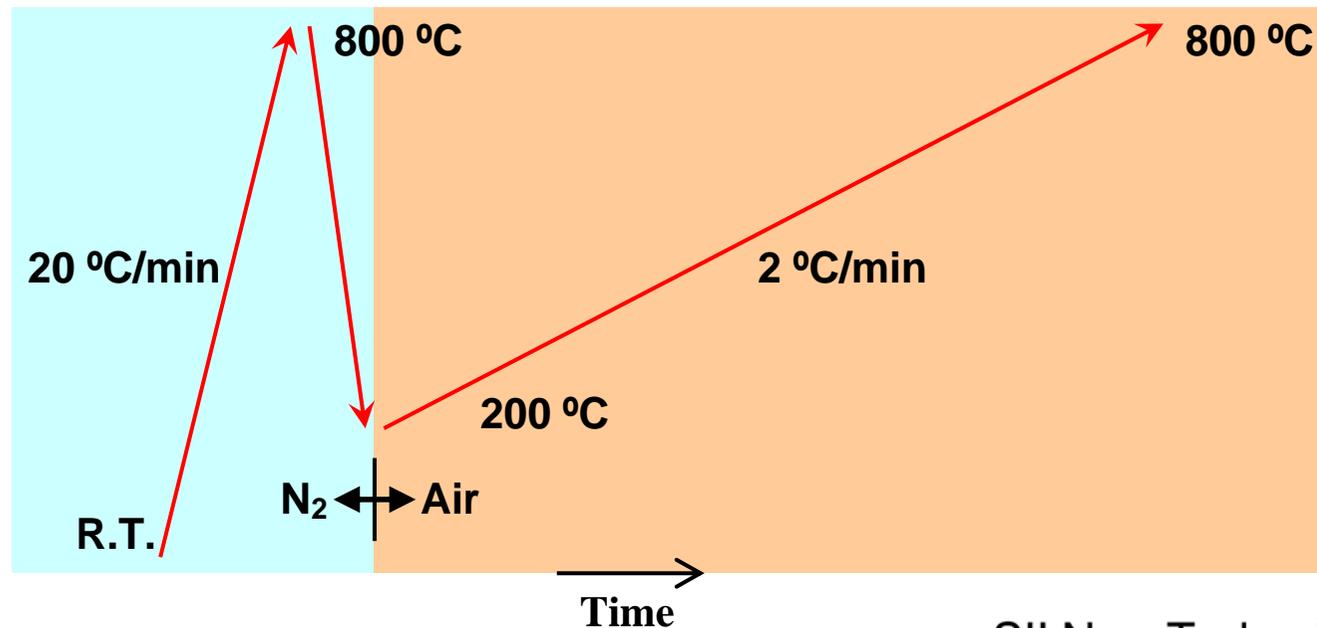
Measurement condition

Sample weigh : 5mg

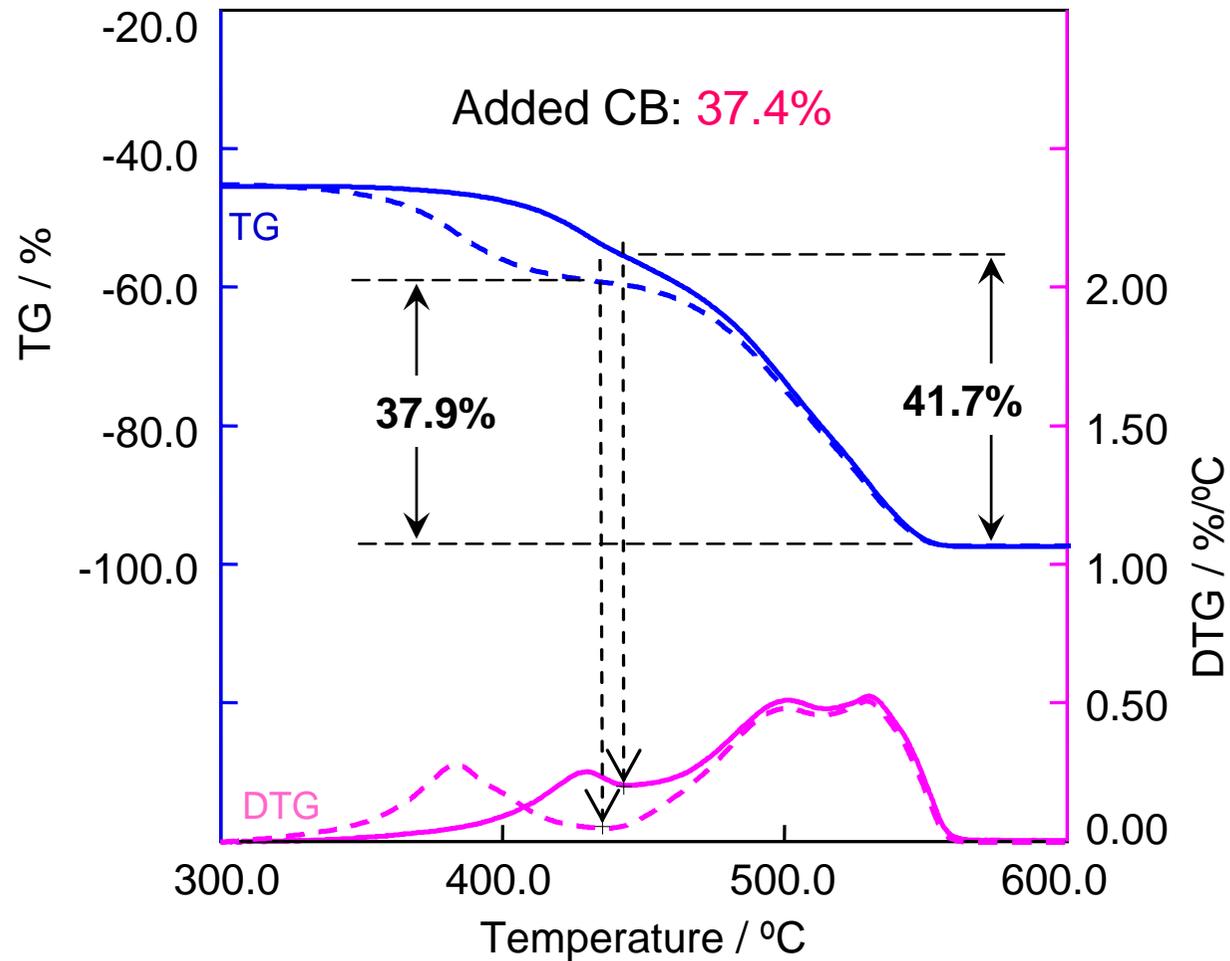
Sample pan : Pt open pan

Purge gas flow Rate : 200ml/min

Temperature program :



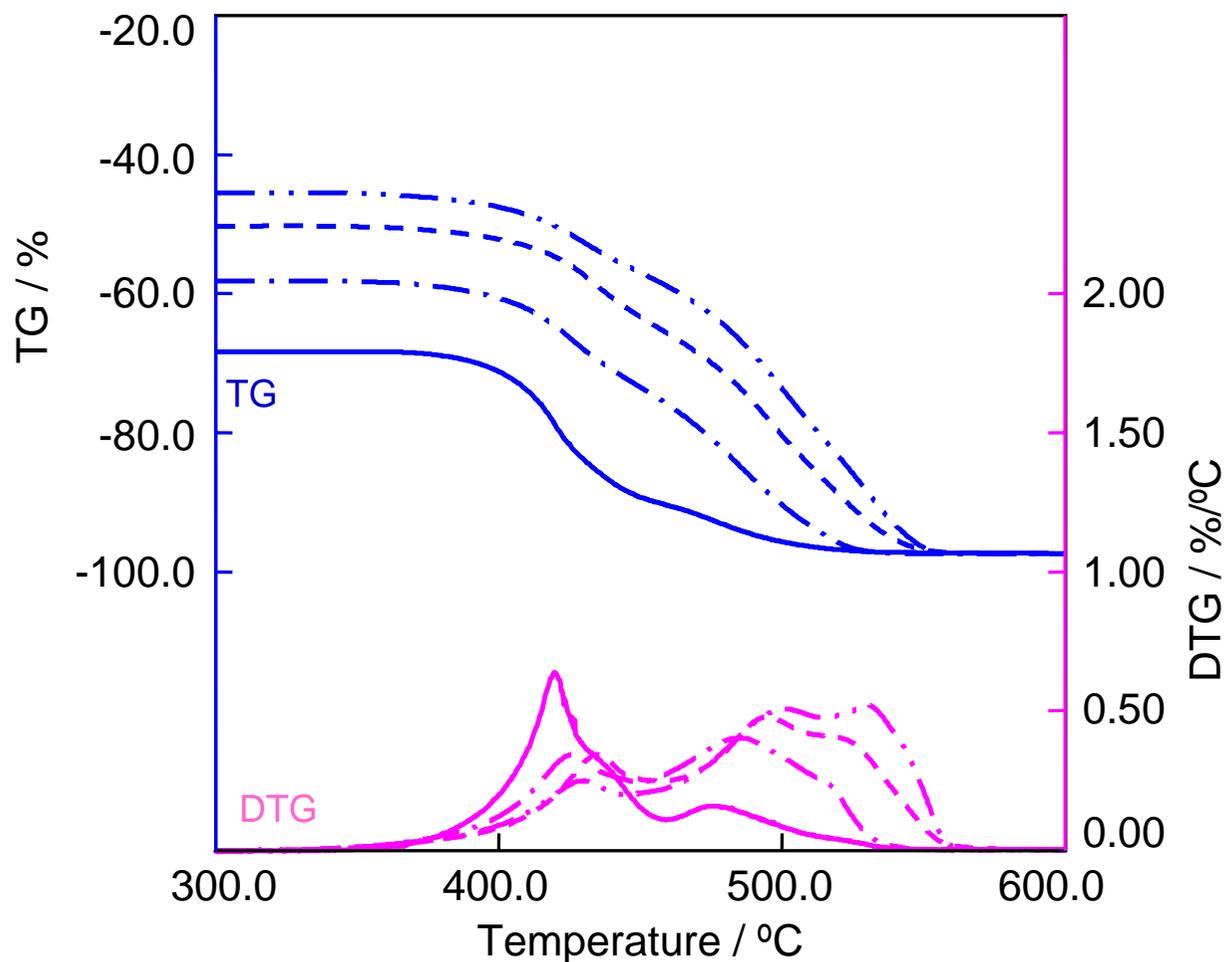
Measurements Results



TG and DTG Curves for added CB in Chloroprene Rubber

Sample : SRF70 (CB 37.4wt%)

Compound ratio dependence



TG and DTG Curves for added CB in Chloroprene Rubber

Sample : SRF10(7.8wt%), SRF30(20.1wt%), SRF50(29.6wt%) and SRF70(37.4wt%)

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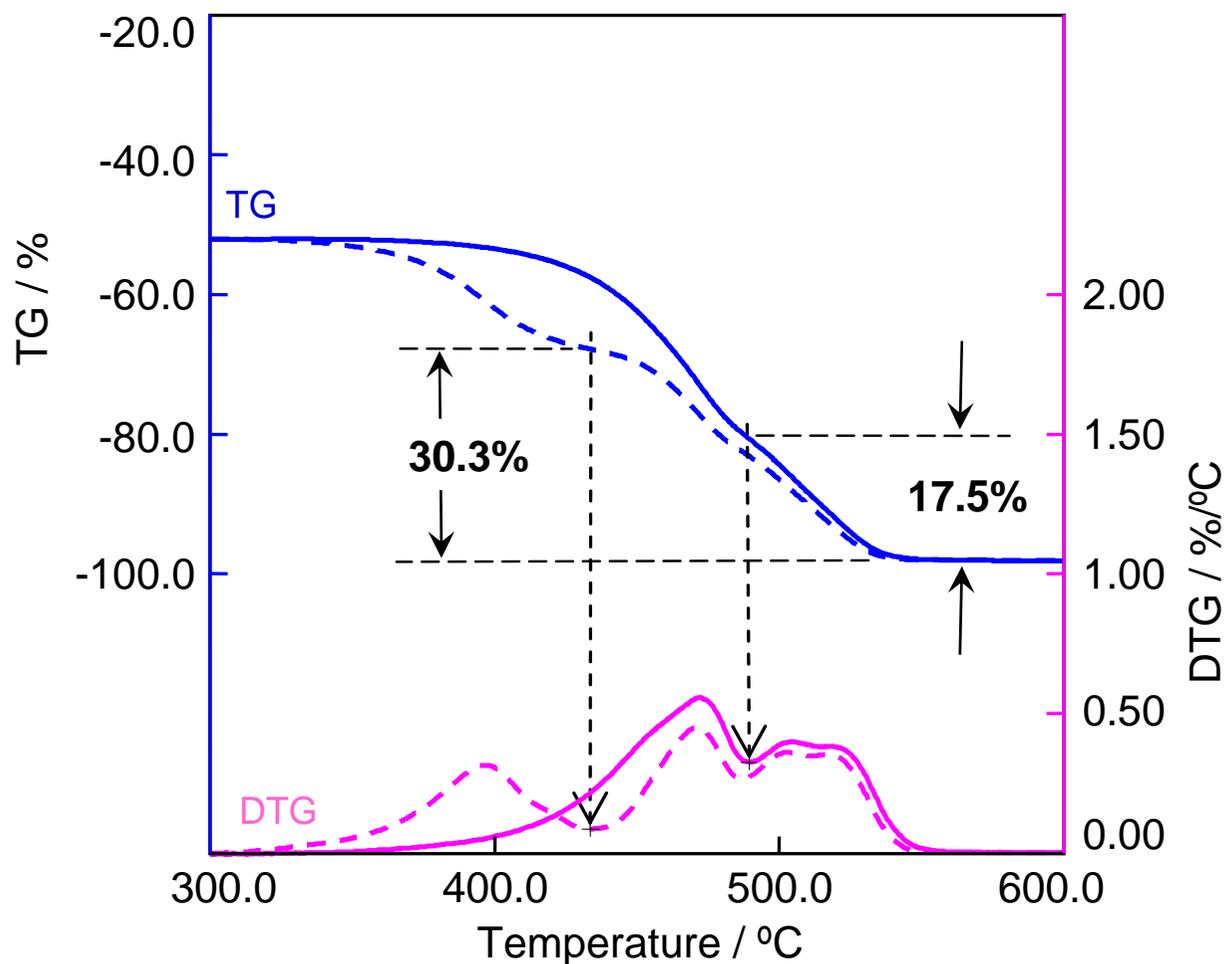
Compound ratio dependence



Quantitative results of the added CB with four different compound ratios

Sample	Added CB (wt%)	Conventional Method 2°C/min (wt%)	Simulation Method 0.1°C/min (wt%)
SRF10	7.8	7.1	7.3
SRF30	20.1	22.2	21.0
SRF50	29.6	32.5	30.0
SRF70	37.4	41.7	37.9

Particle size dependence



TG and DTG Curves for added CB in Chloroprene Rubber

Sample : SAF50 (CB 29.6wt%, Particle size 18nm)

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Particle size dependence



Quantitative results of the added CB with four kinds of particle size

Sample	Added CB (wt%)	Conventional Method 2°C/min (wt%)	Simulation Method 0.1°C/min (wt%)
SAF50	29.6	17.5	30.3
HAF50	29.6	33.9	29.5
SRF50	29.6	32.5	30.0
FT50	29.6	30.9	29.8

Simulation of Heating Rate Conversion ;

- Effective to the separation of the consecutive weight changes.
- Much less measurement time compared to the low heating measurement and CRTA
 - Applicative to the measured data.
- Higher accuracy in the quantitative analysis of CB in rubbers compared to the conventional method.

Thus **Simulation of Heating Rate Conversion** method enables the higher accuracy the quantitative analysis without lowering measurement efficiency.

This method is effective for the quantitative analysis of CB in rubbers.