

中国化学会第十九届全国化学热力学与热分析学术会议



Application of the Real-Time Sample Observation Thermal Analysis

21st April 2018

Nobuaki Okubo

Analytical Application Engineering Department

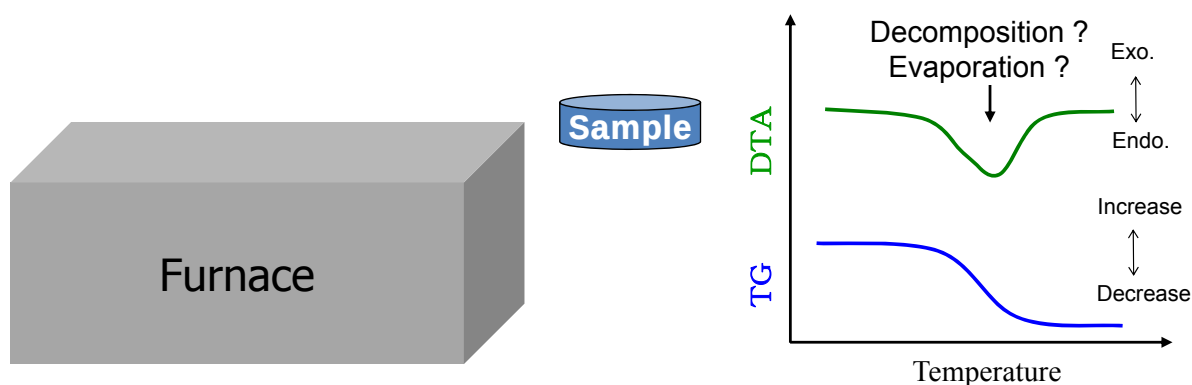
Hitachi High-Tech Science Corporation

Copyright © 2018 Hitachi High-Tech Science Corporation All Rights Reserved.

Introduction - The Problem

HITACHI
Inspire the Next

- In conventional thermal analyzers, samples cannot be viewed directly because they are obscured by the furnace.
- So, thermal analyzer users are left to determine which phenomena occur by reviewing the signal curves obtained during the measurements.



We tried the development of the Thermal Analysis System which could observe a sample during the measurement. So we completed this Real-Time Sample Observation System for DSC, STA, and DMA.



DSC System



STA System



DMA System

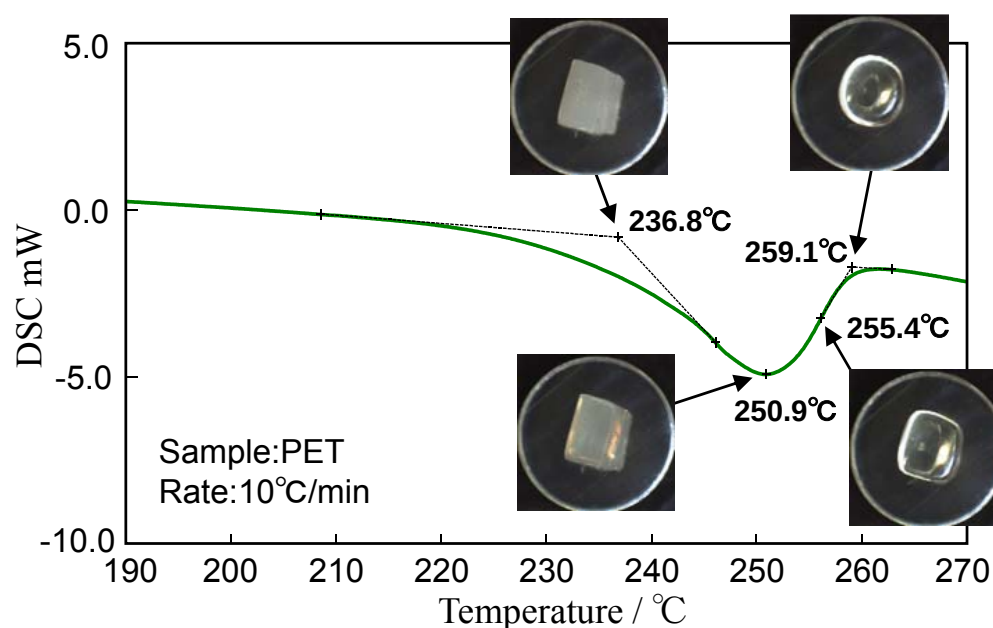
Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

Real-Time Sample Observing DSC Measurement

HITACHI
Inspire the Next

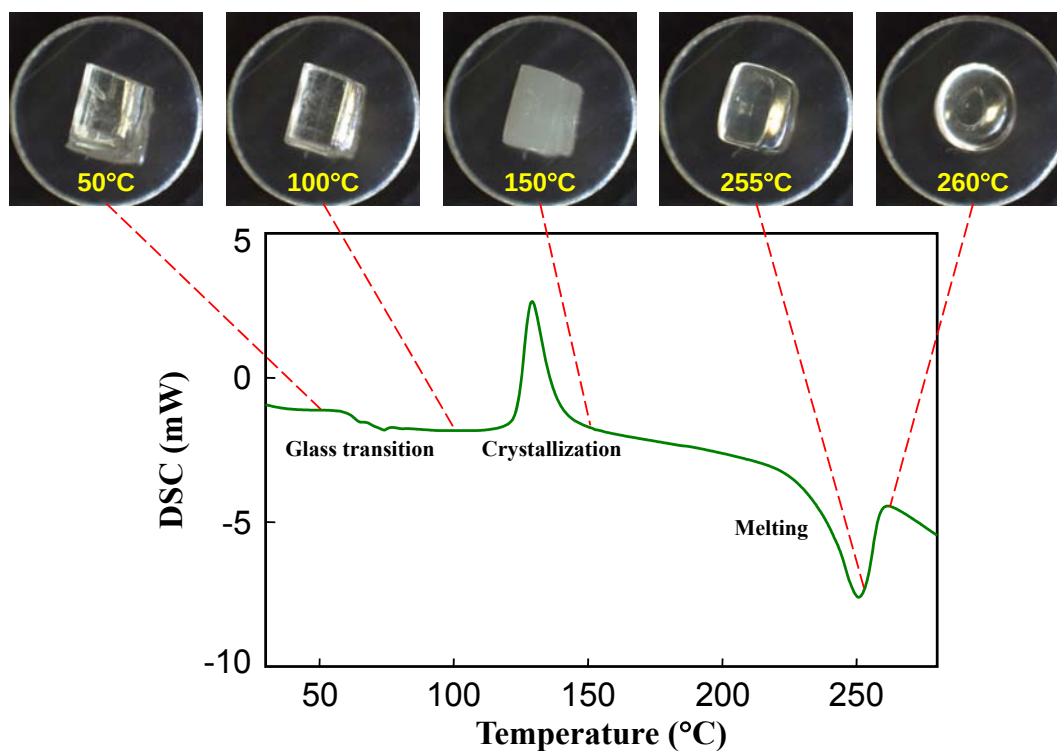
- Characterize broad transitions – zoom in on PET melt



Hitachi High-Tech

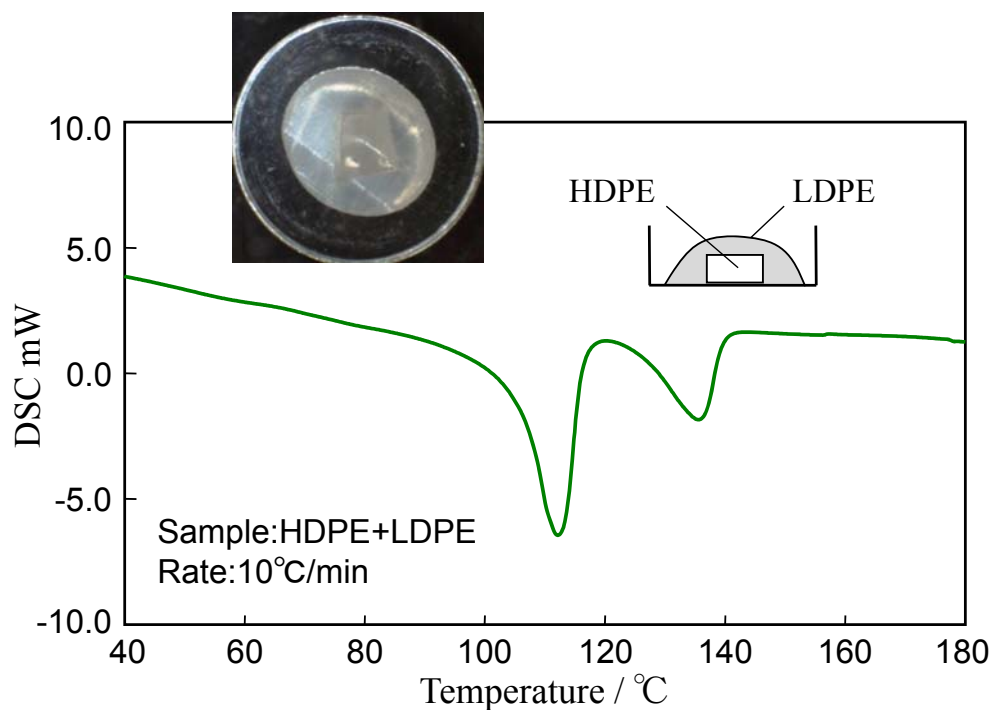
Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

Real View DSC Measurement of PET



Hitachi High-Tech

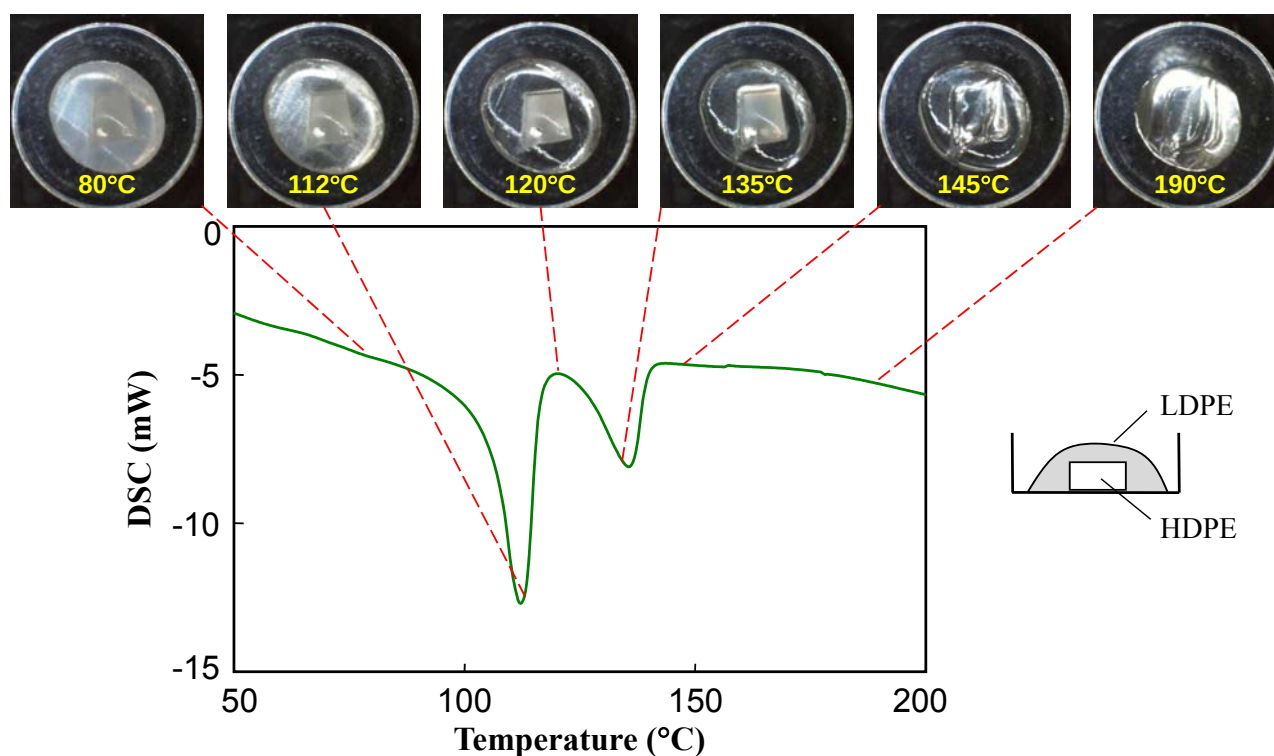
Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.



Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

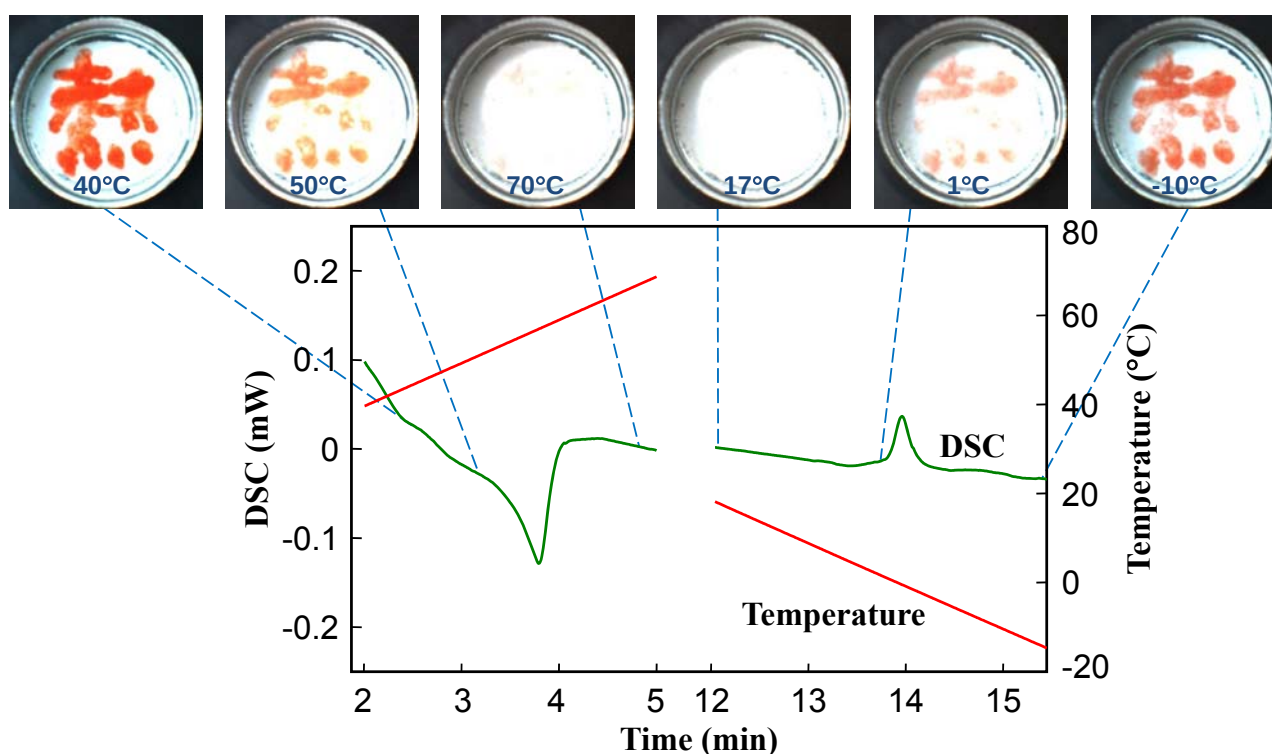
Real View DSC Measurement of HDPE in LDPE



Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

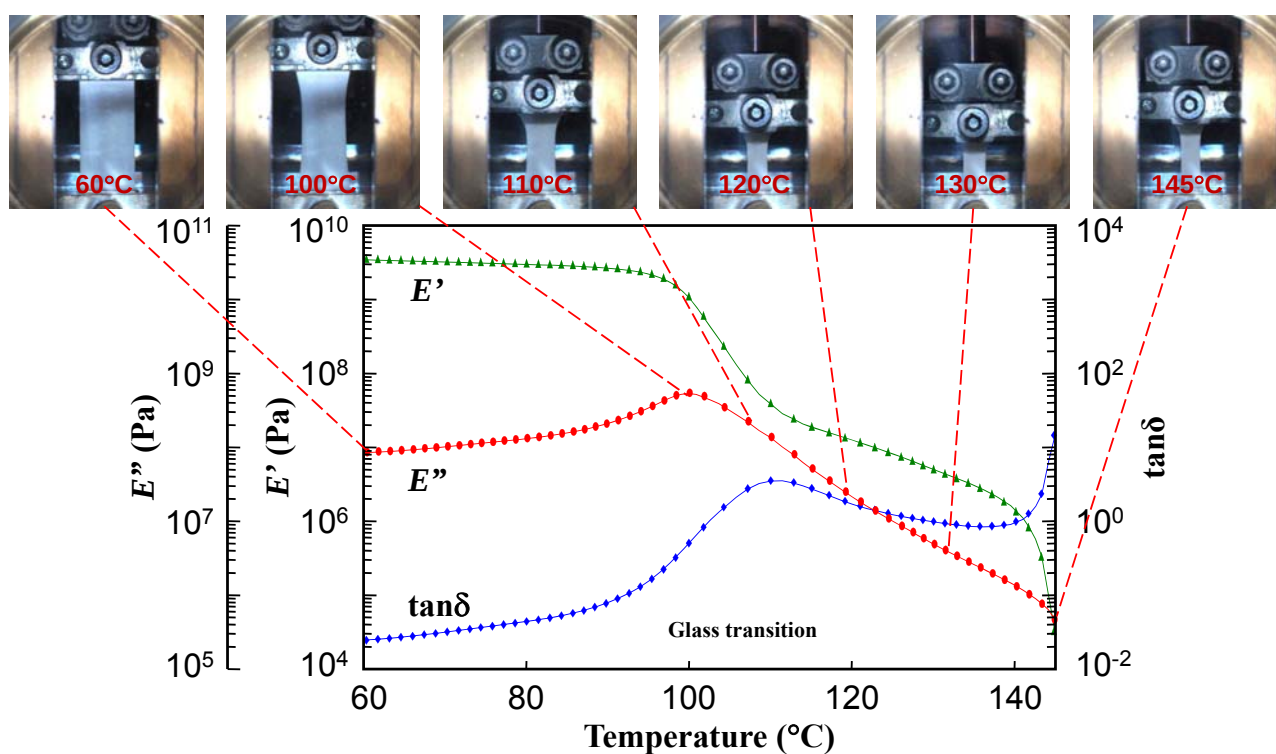
Real View DSC Measurement of Erasable Ink



Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

Real View DMA Measurement of Heat Shrink Film



Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

Real-Time Sample Observation STA System



STA7200RV+RV-2TG



Top View of Furnace

Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.



Balance Beams



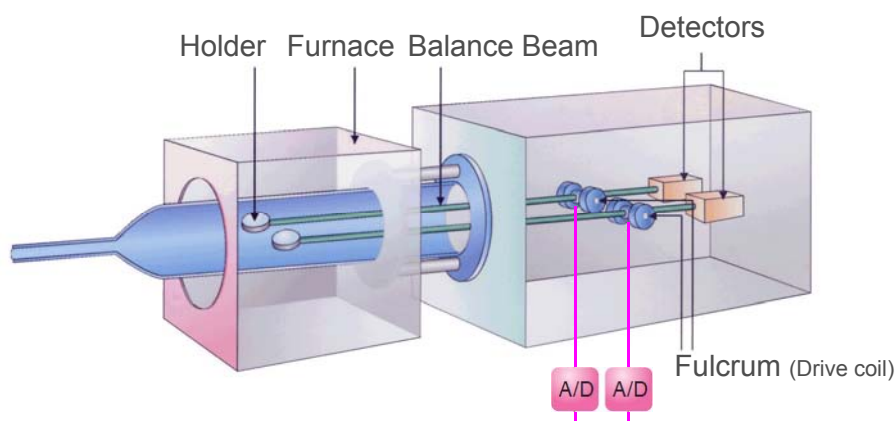
Cut-away Image of Furnace

Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

It is necessary to meet the following conditions to observe sample in the furnace during the measurement.

- Temperature up to 1000°C
- Temperature uniformity
- Maintain sensitivity and baseline stability
- Controlled performance of atmosphere (gas tightness and flow rate)

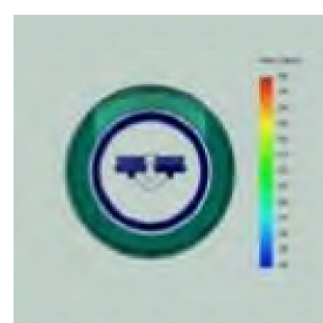
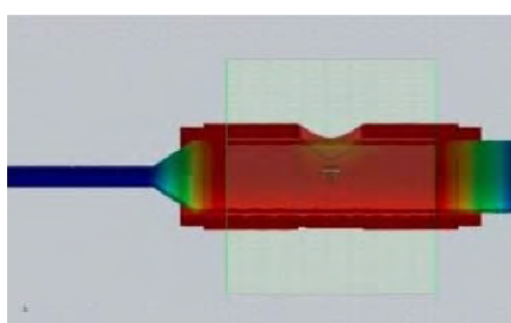
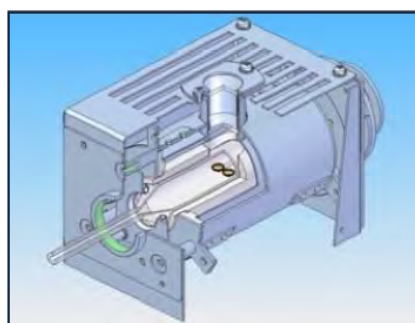
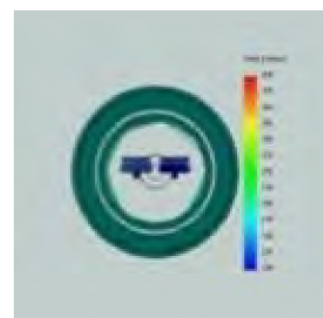
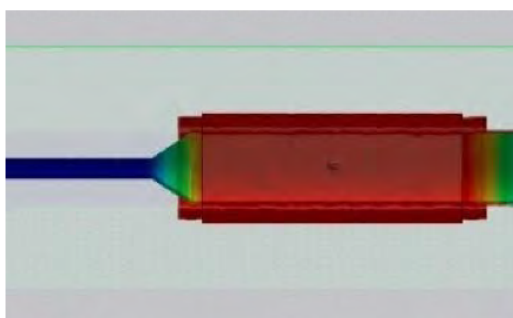
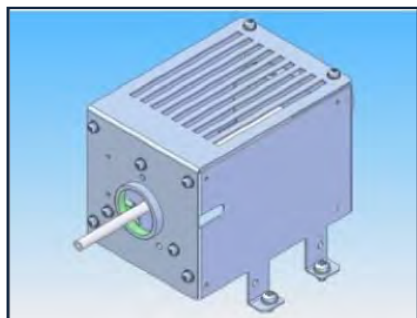


Digital Differential System

Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

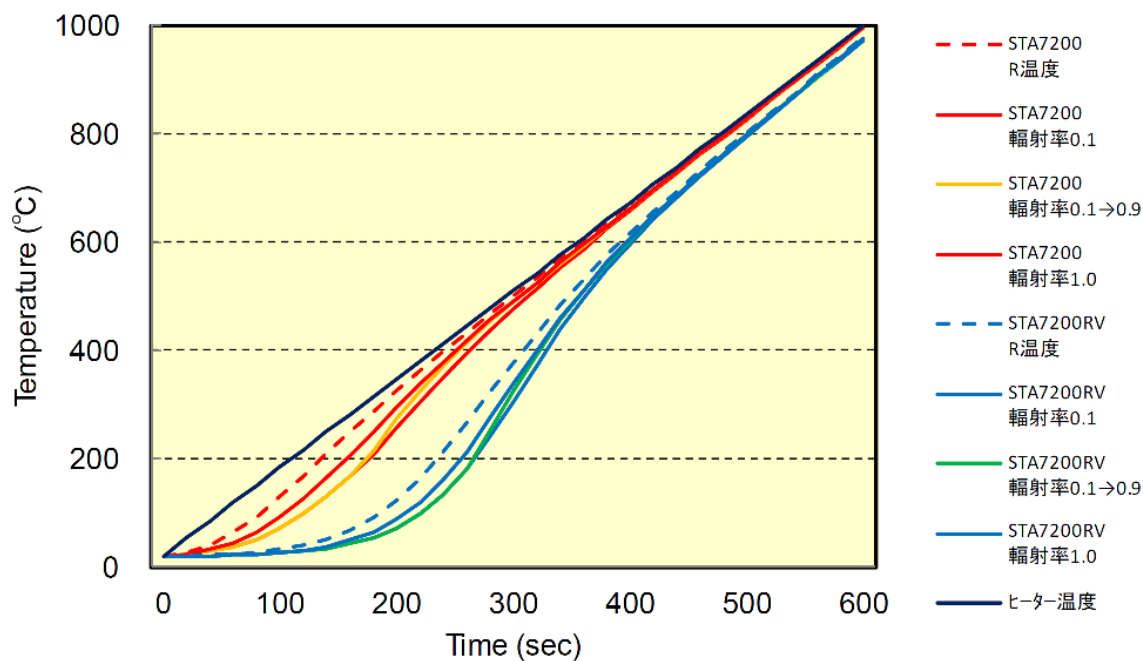
Computer Simulation of the Radiant Heat



Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

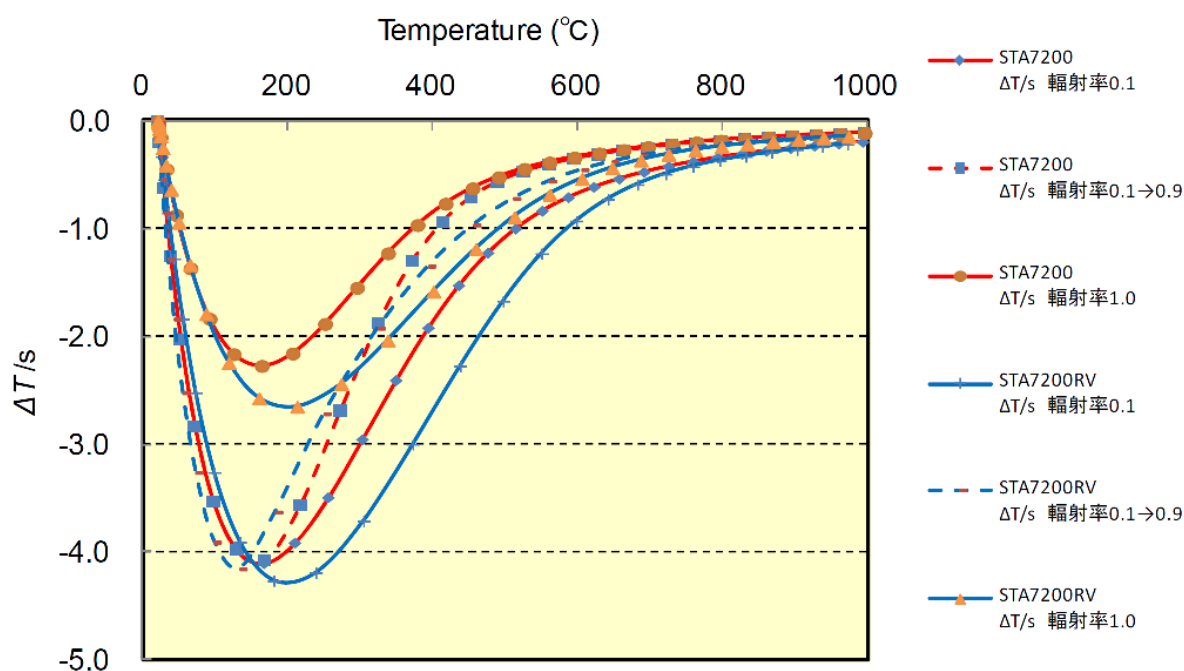
Influence on Sample Temperature of Radiation Factor



Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

Influence on $\Delta T/s$ of Radiation Factor

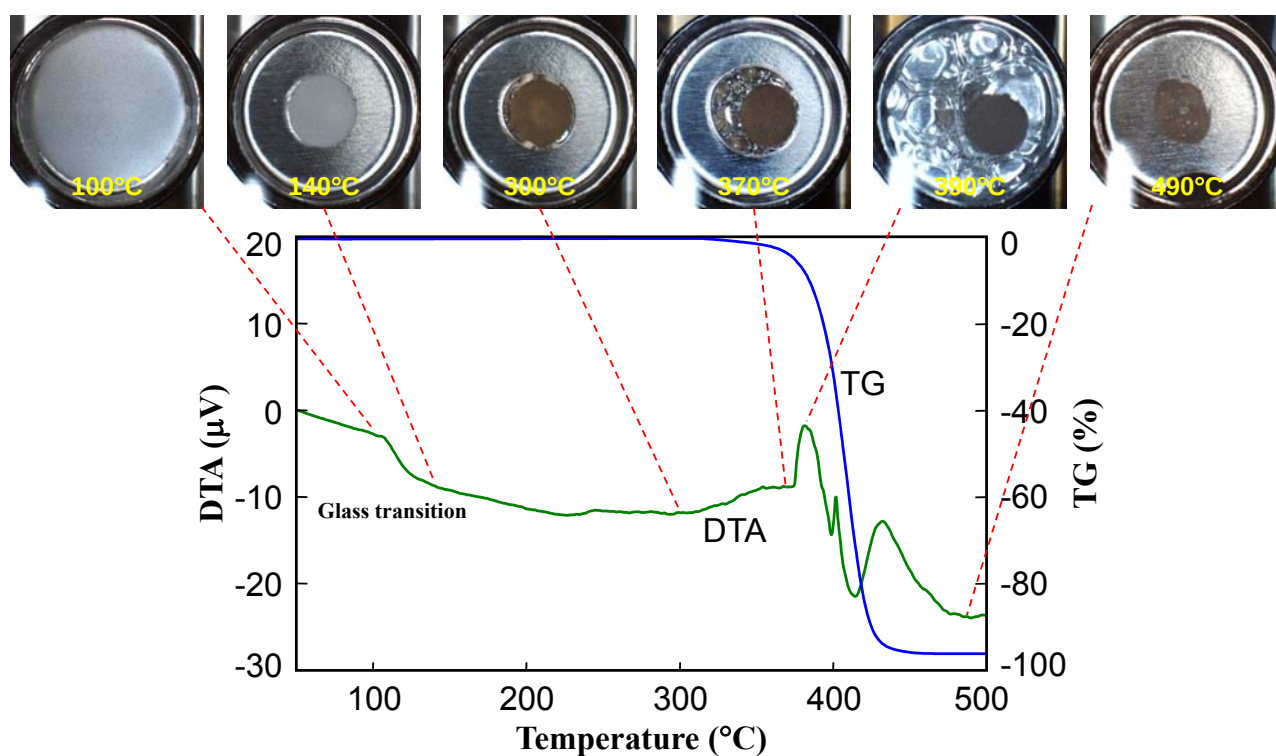


Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

Real-Time Sample Observing STA Measurement

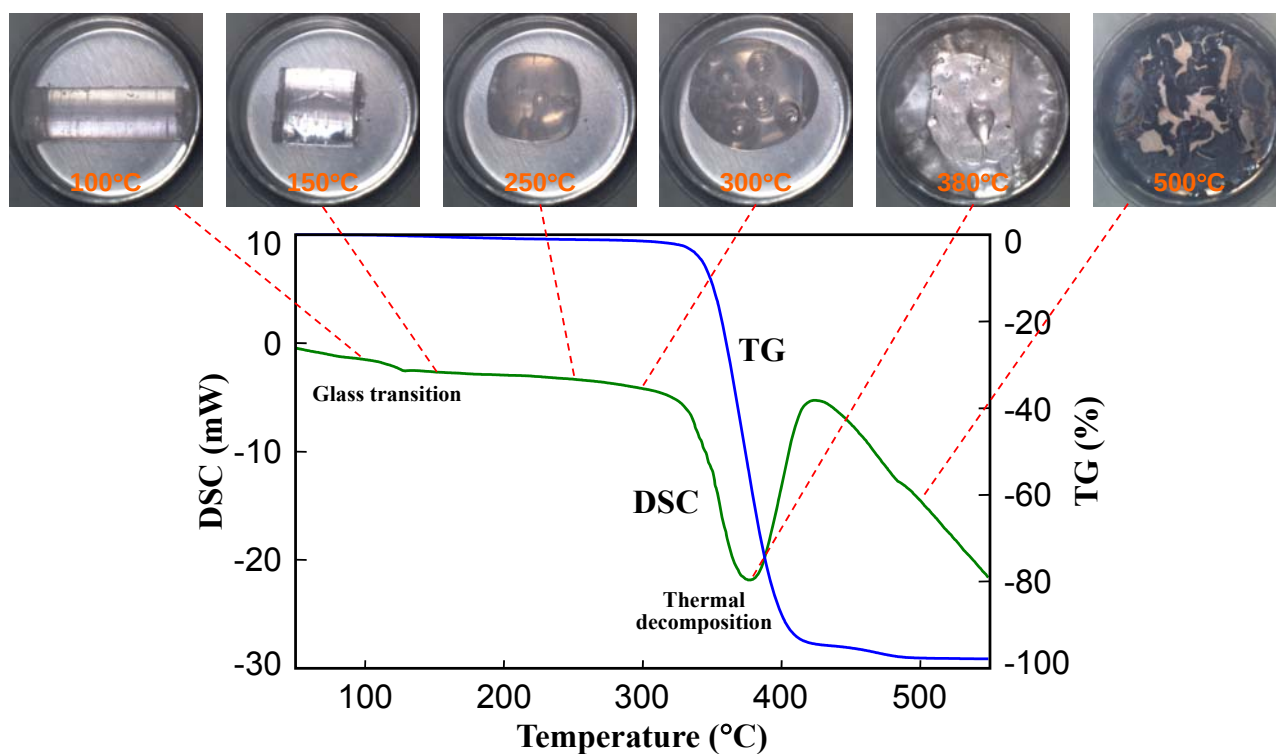
Real View STA Measurement of Heat Shrink Film



Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

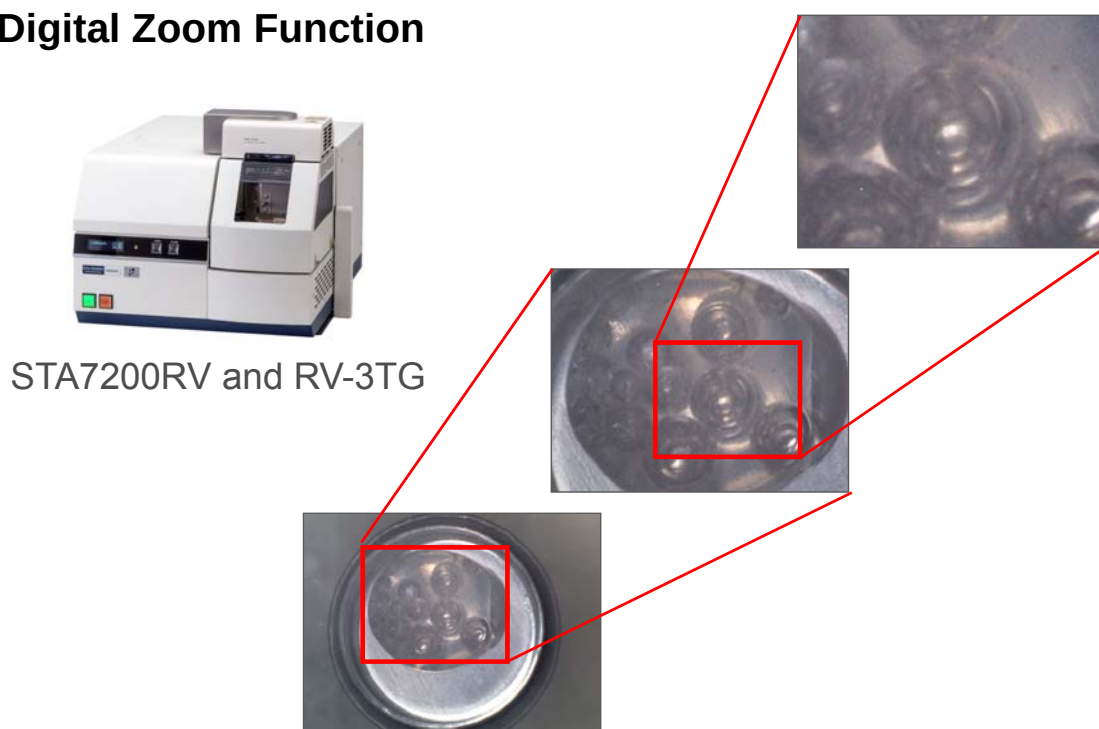
Real View STA Measurement of Plastic Optical Fiber



Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

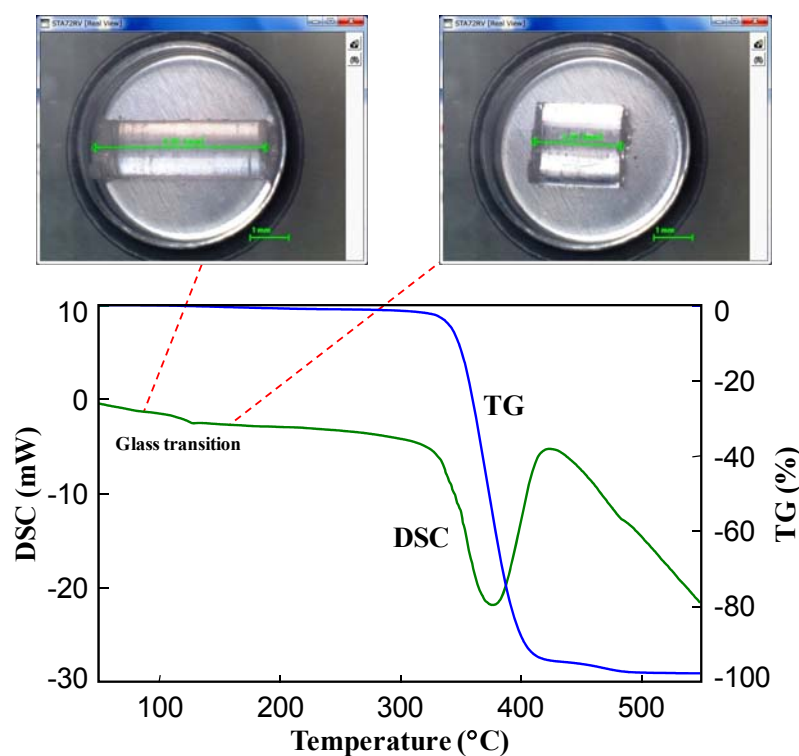
Digital Zoom Function



Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

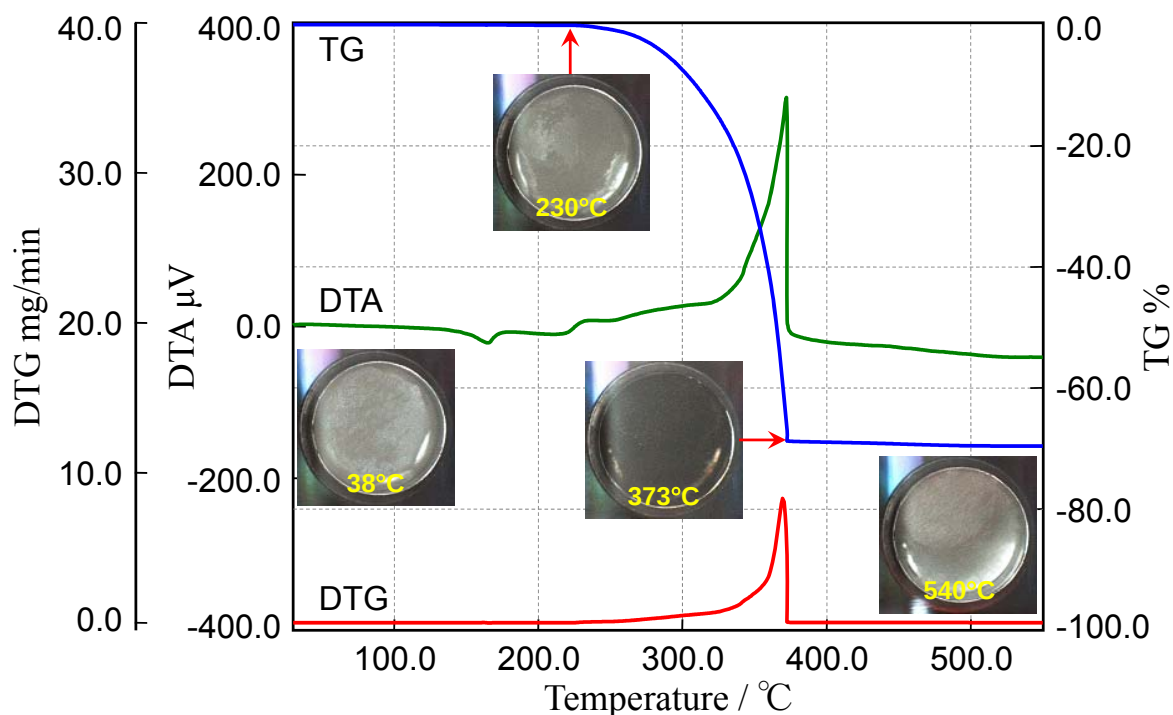
Real View STA Measurement of Plastic Optical Fiber



Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

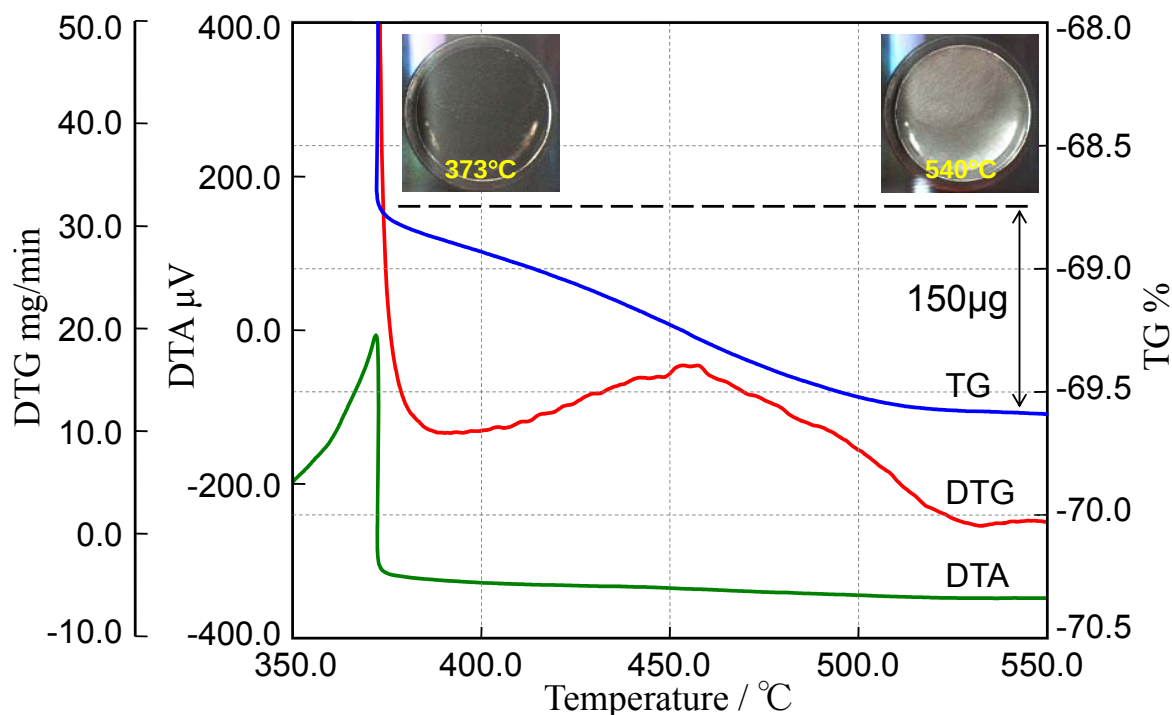
Real-Time Sample Observation STA System



Sample: Glass Fiber Reinforced PP, Rate: 10°C/min, Gas: Air 200ml/min

Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.



Sample: Glass Fiber Reinforced PP, Rate: 10 $^{\circ}$ C/min, Gas: Air 200ml/min

Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.

Summary

We developed the Real-Time Sample Observation System for DSC, STA, and DMA.

Particularly, the furnace of the STA system was enabled by the measurement up to 1000 $^{\circ}$ C by using the computer simulation technique.

We will thereby obtain more detailed information by this systems.



DSC System



STA System



DMA System

Hitachi High-Tech

Copyright ©2018 Hitachi High-Tech Science Corporation All Rights Reserved.