

CEEC-TAC5 & MEDICTA2019



Evaluation for Degradation of Polymer Materials using Sample Observation TG-DSC System

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S. ITO, E. SHIMODA, N. OKUBO, H. TAKAHASHI

Application Development Center

 **Hitachi High-Tech Science Corporation**

We have developed the Thermal Analysis System which could observe and record a specimen behavior during the measurement.

And we completed this Real-Time Sample Observation System for DSC, STA, and DMA.



DSC System



STA System

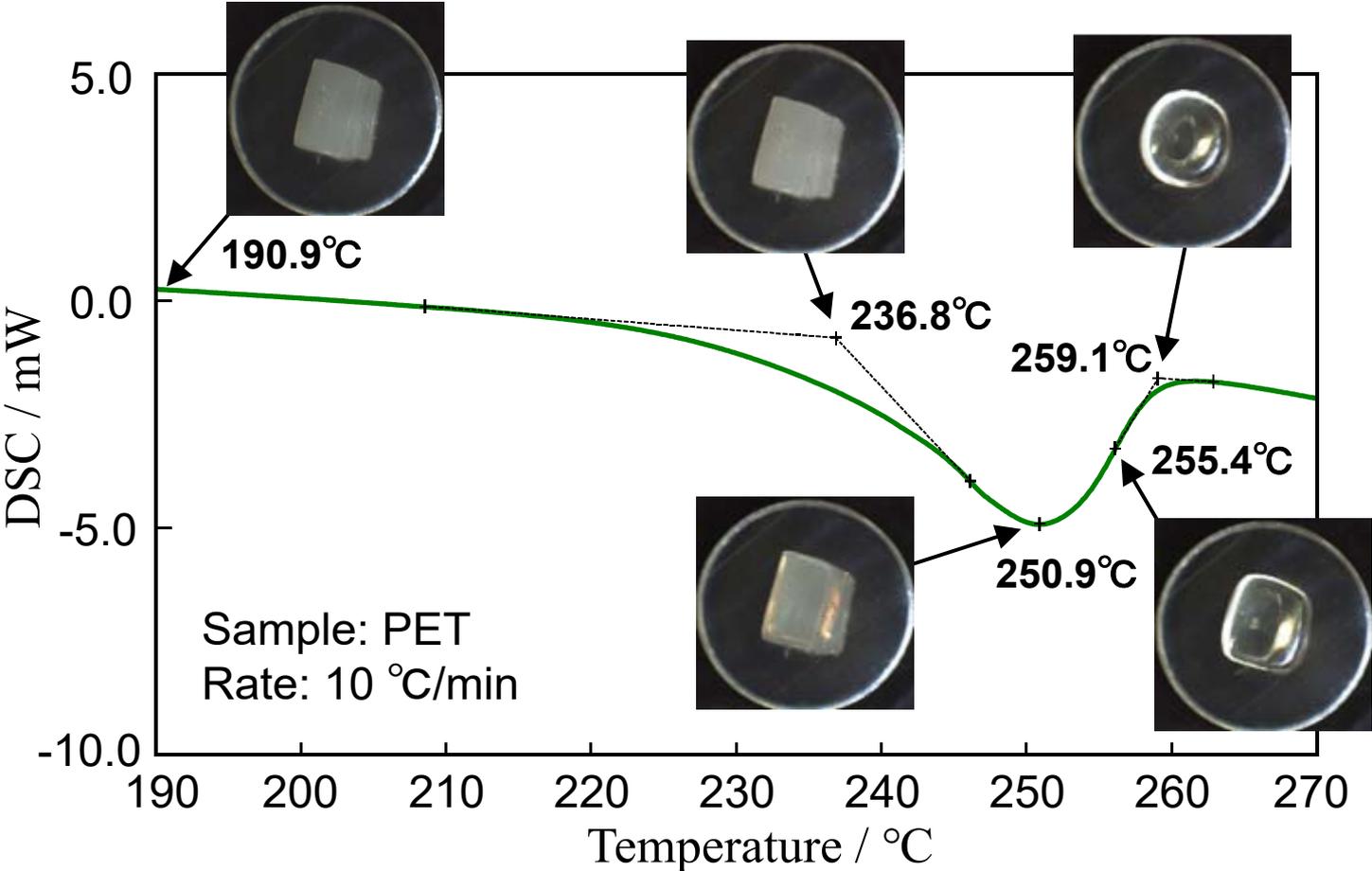


DMA System

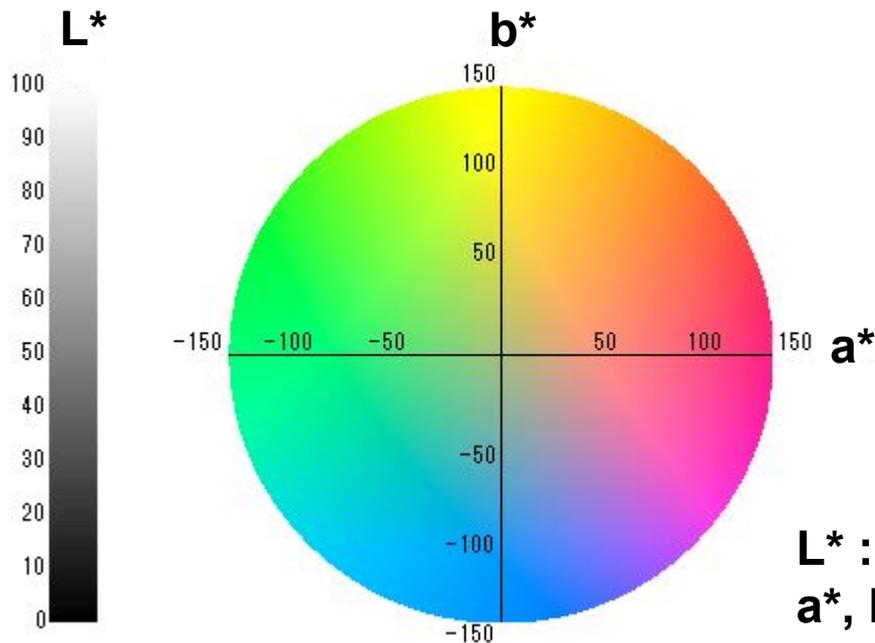
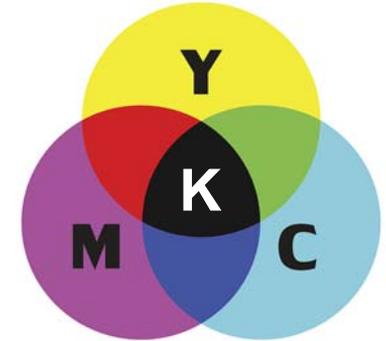
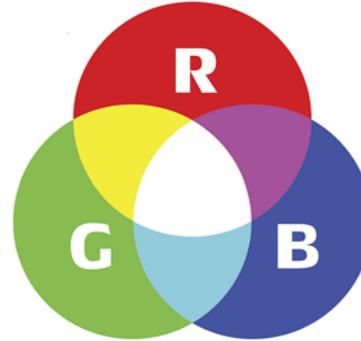
Analysis of sample property change from visual aspect such as color and shape is now available in addition to conventional thermal analysis.



Characterize broad transitions – zoom in on PET melt



- **RGB** value
- **CMYK** value
- **Lab** value



L* : Brightness
a*, b* : Chromaticity

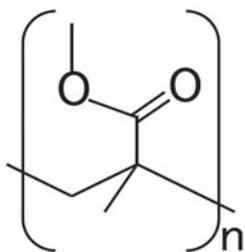
Recently, for the purpose of the lightweighting of the automotive vehicle and the railway vehicle, the change to the plastic materials of the window glass is underway.

Polycarbonate (PC) is used for the window materials of some automotive vehicle and railway vehicle. PC has advantages for light weight and high impact strength as compared to inorganic glass.

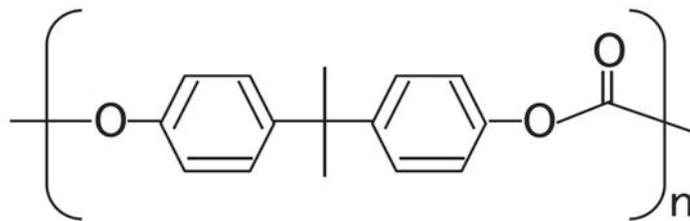
However, plastic glass is easy to deteriorate in comparison with inorganic glass. One of the deterioration peculiar to plastic glass includes **Yellowing**.

In this study, the influence of the heating and the time lapse on the yellowing behavior of the polymer materials for the plastic glass was examined by color indices measurement using the Real-time Sample Observation TG-DSC System.

Sample	Polymethylmethacrylate (PMMA) Polycarbonate (PC)
Apparatus	STA200RV (Hitachi High-Tech Science)
Sample Weight	20 mg
Temperature	150, 200 and 230 °C
Atmosphere	Air 200 mL/min



PMMA



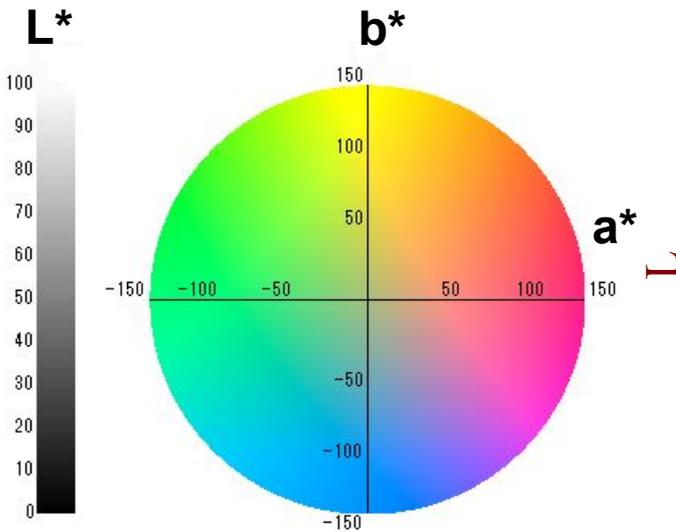
PC

Chemical structure of PMMA and PC

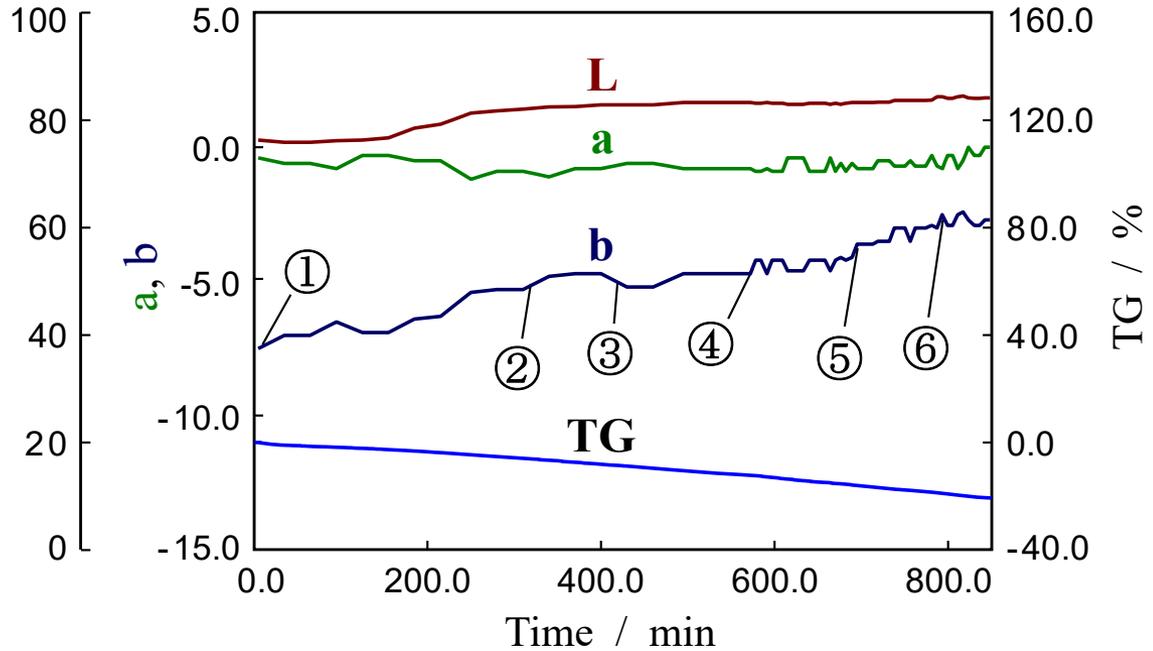


STA200RV

Measurement result for PMMA

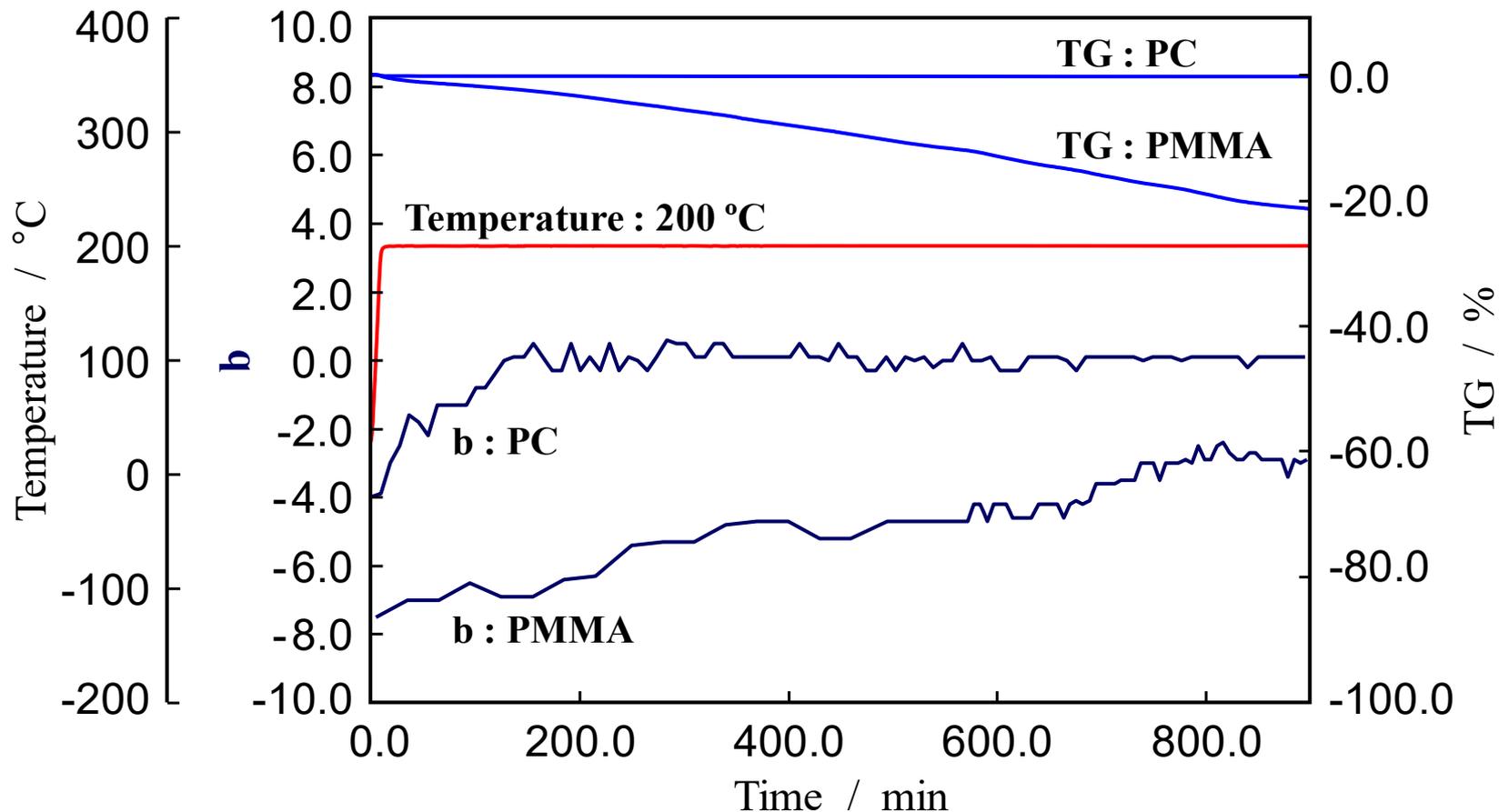


L* : Brightness
a*, b* : Chromaticity



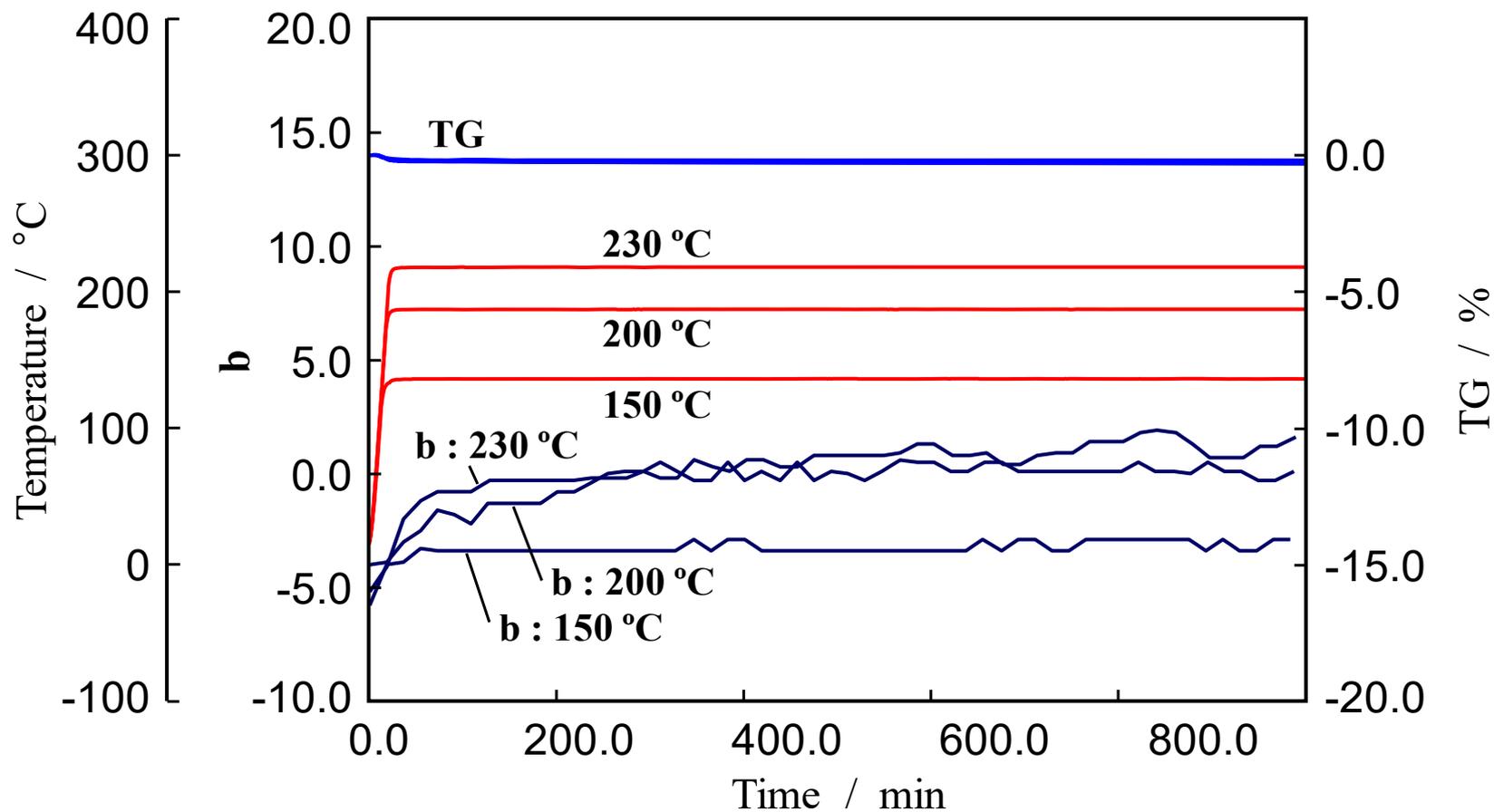
L, a, b and TG curves for PMMA at 200 °C

Measurement results for PMMA and PC



b, TG and temperature curves for PMMA and PC at 200 °C

Measurement results for PC



Respective b, TG and temperature curves for PC at 150, 200 and 230 °C

- An evaluation of yellowing behavior of polymer material by the Real-Time Sample Observation System is useful.
- As a result of having measured about PMMA and PC as representative materials used for plastic glass, the PC occur yellowing earlier than PMMA.
- As a result of having measured temperature dependency of yellowing behavior about PC, the higher temperature make faster the yellowing process.

Thank you for your kind attention



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