

Thermal History Of Electrical Wire Insulating Sheath Polymer

Introduction

Electric wire insulating sheaths are manufactured by extruding a melted and kneaded polymer material onto a core wire such as copper, applying an insulating sheathing, followed by applying an outer sheathing to form cables. Thermal history may occur due to heat treatment during the sheathing process. Therefore, we measured the thermal history of the outer sheathing material using DSC and TMA compression loading method.

Measurement and analysis example

For the DSC measurements, a flat portion of the cable's exterior coating was cut into a 2mm square (approximately 12mg) and placed in an aluminum pan, where it was heated at 10°C/min. For the TMA measurements, a similar flat portion of the exterior coating was cut into a 10mm length piece and heated at 5°C/min under a load of 20mN. Both measurements involved 1st heating and 2nd heating (reheating).

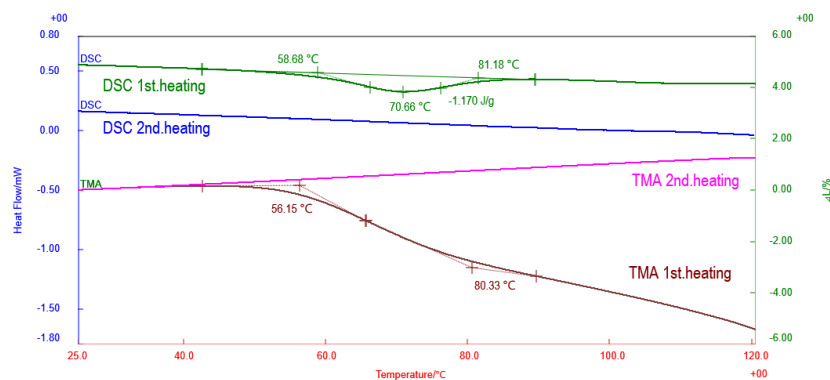


Figure 1: Comparison of DSC and TMA measurement results

The DSC results showed a broad endothermic peak between 60 °C and 80 °C during the 1st heating, which disappeared during the 2nd heating. Similarly, the TMA results also showed shrinkage behavior between 60 °C and 80 °C during the 1st heating, followed by continued shrinkage, but no shrinkage was observed during the 2nd heating, indicating monotonous thermal expansion with increasing the temperature.

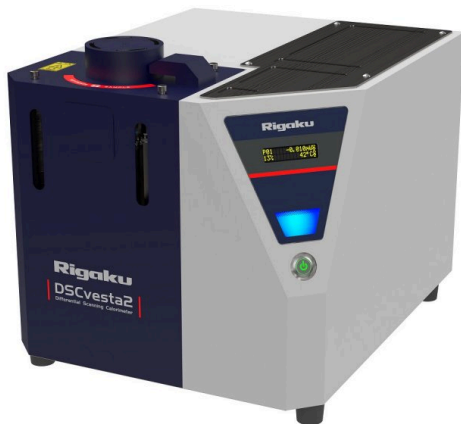
From these results, the endothermic peak observed in DSC and the shrinkage behavior in TMA during the 1st heating are considered irreversible changes, caused by thermal treatment in these temperatures range during manufacturing. In this way, comparing the results from the 1st heating and the 2nd heating (reheating) is an effective way to obtain useful

information about the state of the sample's thermal history resulting from the temperature range to which the sample was exposed.

Recommended equipment and software

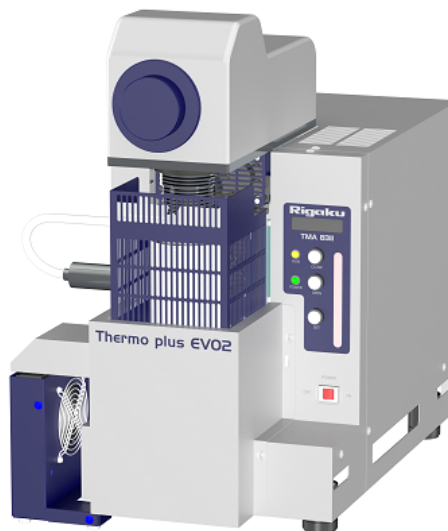
- ▶ [DSCvesta2](#) + Refrigerated cooling unit
- ▶ [TMA8311](#) Compression loading attachment
- ▶ [Vulios](#) measurement and analysis software

Related products



DSCvesta2

DSC with industry-first self-diagnostic feature and industry's highest temperature range



TMA8311

TMA is the measurement of a change in dimension or mechanical property of the sample while it is subjected to a controlled temperature program.



Vullios

Measurement and analysis software for Rigaku Thermal Analysis instruments