Application Note B-TA1030

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TA1030 - Thermal decomposition of starch-based filler by sample observation STA

Introduction

Starch is the one of the most abundant, renewable and inexpensive biodegradable polymer. Since then, the production of biodegradable starch-based derivatives as an alternative to the conventional petroleum based products have attracted much attention. Starch is combined with plasticizers such as vegetable oil; and fillers such as cellulose material to produce the starch-based filler. In this application, we investigate the thermal behavior of a starch-based filler using STA and illustrate the effectiveness of sample observation function.

Measurement and results

A 3 mg sample amount weighed in a Al pan was heated at 20℃/min from RT~600℃ in air atmosphere flowing at 300ml/min. The STA measurement results are shown below. The TG result indicates that immediately after the start of measurement, a mass loss of nearly 5% can be observed which is due to the devolatilization of plasticizers and dehydration of residual water. As the temperature increases, an endothermic peak at 162℃ can be observed due to melting which was confirmed in a DSC instrument. Then from 240℃, a stepwise decrease in weight can observed on the TG curve associated with a series of exothermic reactions. On the captured images, the sample color changed from white to brown at 255℃ followed by a volumetric shrinkage associated with dark color changes at 276℃ and an intense decrease in size and color changes from 300℃ onwards, revealing combustion reaction of carbon in different stages and the formation of soot at more than 500℃. The different stages of exothermic reaction are due to combustion of cellulose and fillers, followed by the combustion of starch components at high temperature region. At more than 550℃, we can observe a 100% mass loss as revealed on the captured sample image.

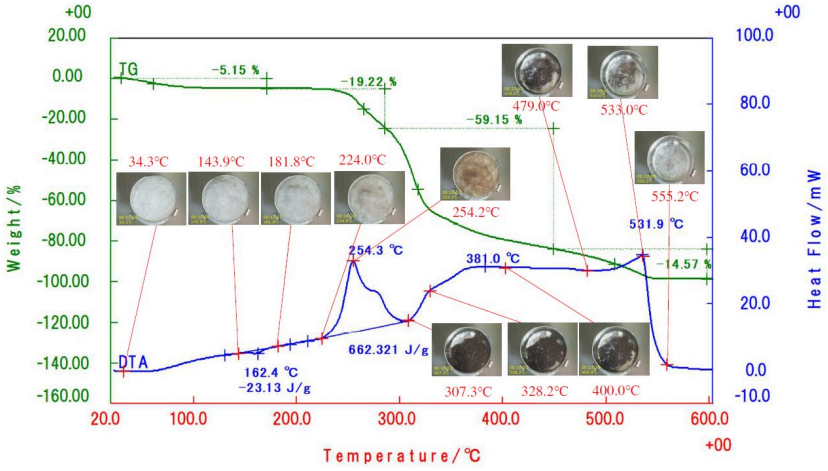

Figure 1: Measurement result of starch-based filler by sample observation STA (TG-DSC)

Reference

Polymers, 2022, **14**, 664