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TA5009 - Thermal decomposition reaction of acetylacetonato zinc monohydrate in humidity

Introduction

User can study the detail of influenced heating process of raw material by changing water vapor partial pressure in the atmosphere employed TG-DTA connected to the humidity generator.

Traditional TG-DTA can be measured by controlling temperature with time as parameter which has no relation with sample change, on the other hand, SCTG (Dynamic TG) can be measured by controlling temperature with sample amount change as parameter. Compared Dynamic TG to traditional TG-DTA, it is available to measure with enhancing the resolution and prompting gradual reaction of sample.

We studied the thermal behavior of acetylacetonato zinc monohydrate ($C_{10}H_{14}Zn \cdot H_2O$) in N_2 atmosphere, which controlled various water vapor concentrations by TG-DTA measurement.

Instrument

The compact humidity generator is connected to the TG-DTA for measurements under water vapor atmosphere with a constant relative humidity. Equipped with a polymer type relative humidity sensor and high precision temperature sensor, its response to various water vapor concentrations is quick and stability for longer measurement is realized.

Dynamic TG

Dynamic TG is a sample controlled thermogravimetry where the rate of the sample's mass loss is set as a parameter while controlling the temperature.

Measurement and analysis

Figure 1 illustrates comparison for acetylacetonato zinc monohydrate in controlled humidity.

Over 90% of mass loss is observed in dry gas, the measurement sample almost evaporate, only the ZnO remains as partially. As increasing the water vapor concentrations, the reaction shifts to low temperature and formation rate of ZnO increases. The mass loss at $P_{H_2O}=9.3$ kPa is corresponding to the theoretical formation rate of ZnO, we can understand only decomposition is occurred without evaporation.

Figure 2 illustrates comparison of DTA for acetylacetonato zinc monohydrate in controlled humidity.

In dry atmosphere, it is observed the 4 endothermic peaks during 80°C to 200°C and the phenomena are occurred dehydration, melting and evaporation in order of precedence. As increasing the water vapor concentration, there is tendency observed the changing to two broad peaks during 100°C to 150°C. These two endothermic peaks due to decomposition are observed at $P_{H_2O}=9.3$ kPa, hence in the results, the reaction is different from dry atmosphere.

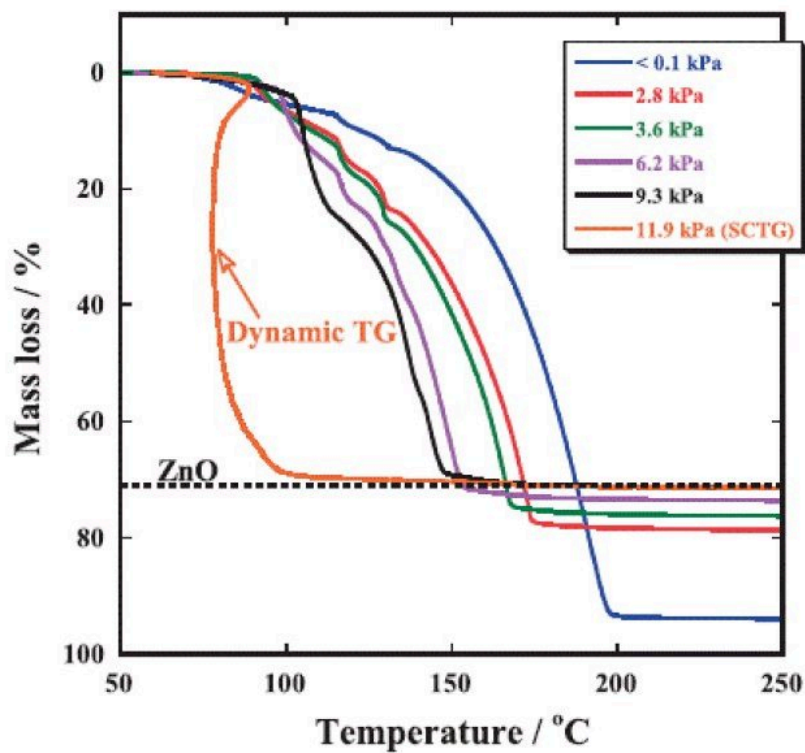


Figure 1: Comparison of TG mass loss for acetylacetonato zinc monohydrate in various partial pressures of water in nitrogen atmosphere of controlled humidity

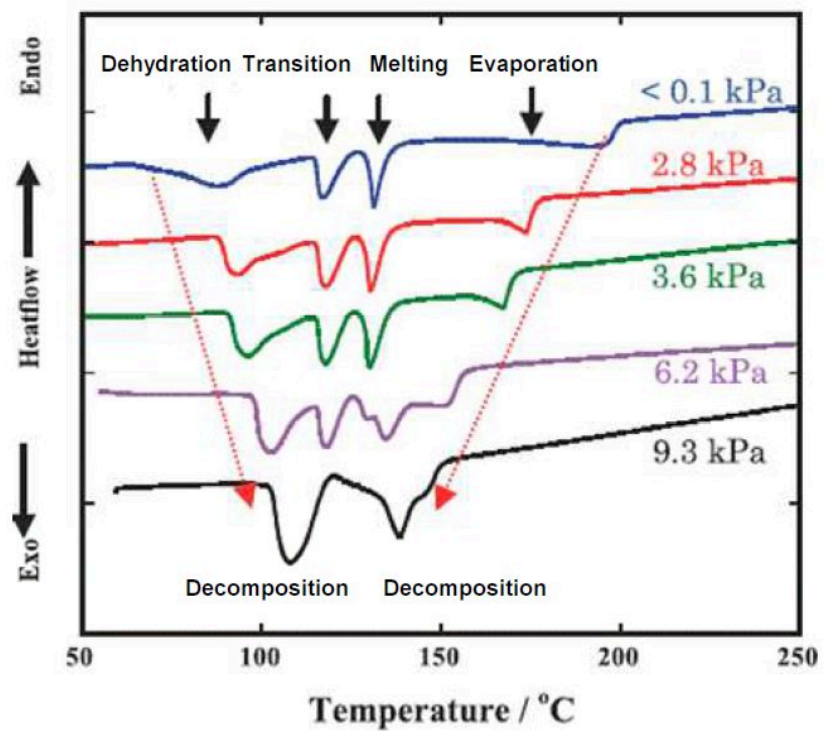


Figure 2: Comparison of DTA for acetylacetonato zinc monohydrate in various partial pressures of water in nitrogen atmosphere of controlled humidity