Application Note TA5001

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TA5001 - Thermal change of indium acetylacetonate

Introduction

Indium oxide (In_2O_3) is a well-known example of a transparent conductive film material. Although the typical process is sol-gel process, chemical vapor deposition method, and physical vapor deposition method, these processes always include heating process from raw material. Thus, it is important to know the exact thermal property of the raw material for efficiency of total process [1].

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

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.

Measurement and analysis

The measurement sample was used indium acetylacetonate raw material which for precursor of In_2O_3, TG-DTA was performed using a Thermo Plus TG8121 system equipped with sample-controlled thermogavimetry and connected to humidity generator, HUM-1. The measurement sample (10 mg) was heated up to 600℃ at 10℃/min in humidity controlled nitrogen atmosphere.

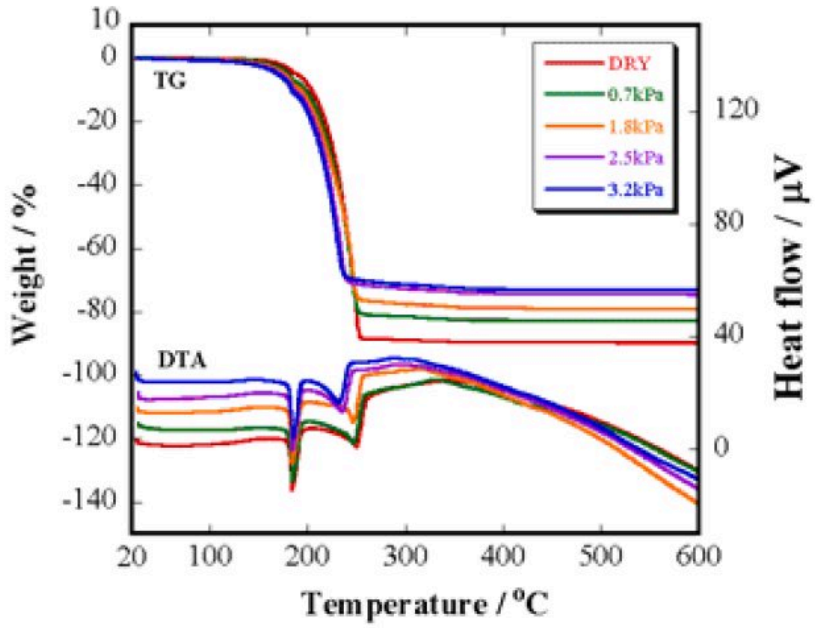

Figure 1 : Comparison of TG and DTA curves for indium acetylacetonate between dry nitrogen atmosphere and nitrogen atmosphere

Figure 1. illustrates a comparison of the TG and DTA curves of indium acetylacetonate in nitrogen atmosphere of controlled humidity. As increasing water vapor partial pressure, the reaction temperature shifts to low temperature. The endothermic peaks due to fusion have little influenced by controlling water vapor partial pressure. When analyze the residual substance by XRD measurement in either condition, only In_2O_3 is confirmed.

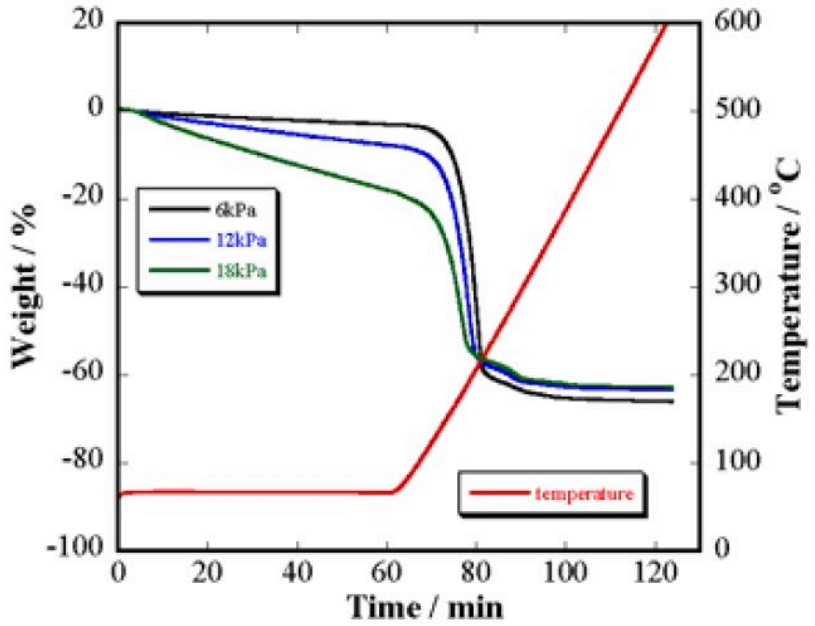

Figure 2: (a) ThermoGravimetry (TG) measurement of indium acetylacetonate in high concentration of water vapor partial pressure

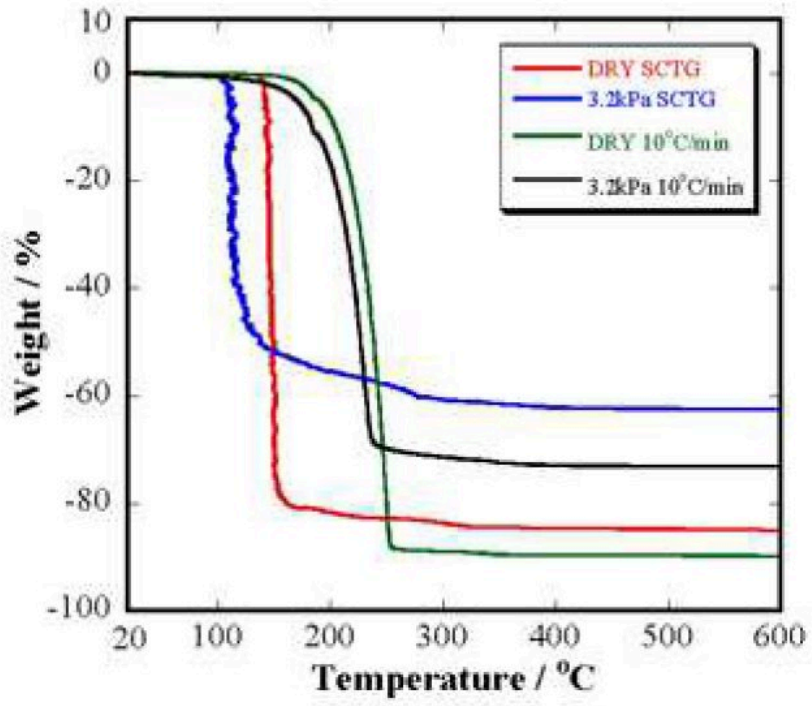

Figure 2: (b) Sample controlled ThermoGravimetry (SCTG) measurement of indium acetylacetonate in high concentration of water vapor partial pressure

Figure 2 illustrates a comparison TG and SCTG curves in high concentration of water vapor partial pressure. As increasing the concentration of water vapor partial pressure, decrease mass-loss rate, and the residual substance amount after the measurement unspreads at 37% in over 12 kPa of water vapor partial pressure. It suggested that water vapor in the atmosphere affects preferentially induced hydrolysis reaction of indium acetylacetonate and forms single product.

Reference

[1] Supervising editor Yutaka SAWADA, *Transparent conductive film II*, CMC publishing, 2007.