Application Note B-TA1005

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TA1005 - Proximate analysis of coal

Introduction

Ideally, a high grade coal has a very low moisture content, volatile matter of less than 14% and a fixed carbon content of more than 86%. Proximate analysis in coal involves the quantification of moisture, amount of volatiles, total carbon and ash contents. In the conventional methods, each of these parameters is analyzed in a separate technique which is tedious and time-consuming. The use of thermogravimetry is an effective means of solving these drawbacks and is able to perform proximate analysis in a single measurement. In this application, proximate analysis in coal is performed using sample observation TG-DTA.

Measurements and results

The figure shows the proximate analysis result of coal using TG-DTA. Here, a 10 mg sample weighed in a Pt pan was heated up to 100°C under N_2 atmosphere and temperature was held. Then, the temperature was increased to 950°C and temperature hold was applied. After which, the atmosphere was switched from inert to air atmosphere while continuously holding the temperature. The result reveals that a 1.95% mass loss was observed due to dehydration as the sample was heated atmosphere up to 100°C. Then a second stage mass loss of 29.89% can be observed during heating from 100°C to 950°C, which is due to thermal decomposition where the volatile gases may evolve. Immediately after changing the atmosphere from inert to air, an exothermic reaction can be confirmed due to combustion of fixed carbon in coal associated with a mass loss of 66%. Calculating the total mass loss results to quantification of total ash, which is the residue after combustion. In this application, the total mass loss is 97.86% and the total ash is 2.14%. This application has clearly demonstrated that quantification of moisture content, volatile matter, fixed carbon content and ash in coal can be measured in just a single measurement thru TG-DTA technique.

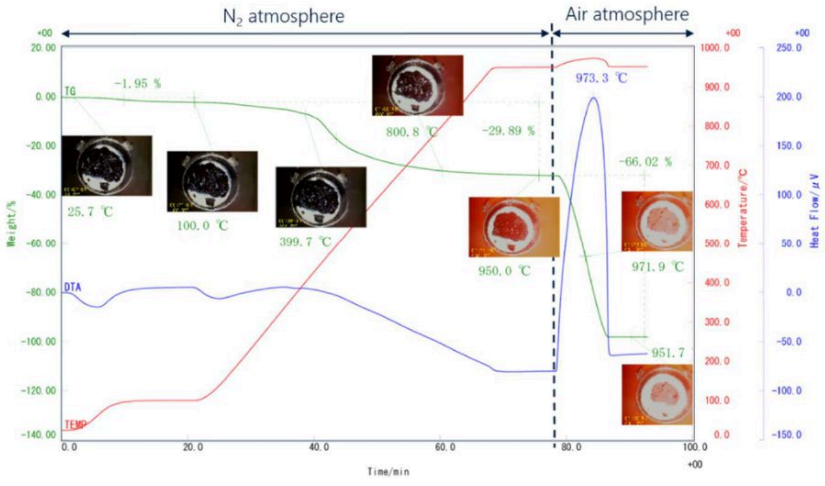

Figure 1: Proximate analysis of coal using sample observation TG-DTA

Figure 1 show that from dehydration up to initial stage of thermal decomposition, the sample did not show any changes up to 400°C. Furthermore, heating the sample up to 950°C exhibited a volumetric decrease in the sample size. Finally, when the atmosphere was changed to air, the sample color changed from black to white with simultaneous decrease in sample size which clearly denotes the completion of combustion.

Using the sample observation TG-DTA has enabled us to confirm the significant visual changes in the sample during a reaction throughout the measurement.