A TGA/DTA-MS investigation on the difference between organic-rich and organic-free mudstones in pyrolysis process

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The role of water plays on petroleum generation has been proved to be very important. The previous studies mostly focus on the hydrous pyrolysis and characteristics of added water in the process. However, the simulation experiment can't fully represent the real formation. The water and other inorganic and organic products in the real formation should be learned more that it will be useful for further studying the relationship between water and hydrocarbon generation. Thermogravimetric analysis (TGA) and differential thermal analysis (DTA) combined with mass spectrometry (MS) afford the opportunity to identify the types and amounts of the compounds under a continuous heating process. In this work, we use TGA/DTA-MS to investigate the pyrolysis differences of organic-rich (CN1) and organic-free (CW1) mudstones in Dongying Sag and then to find the relationship between H_2O, CO_2 and organic matter. The results showed that the pyrolysis process of CN1 and CW1 all can be divided into three stages by the TGA/DTA curves. Sample CW1 released adsorption water and interlayer water, crystal-structural water, carbon dioxide separately in the tree stages. While sample CN1 generated adsorption water, interlayer water and crystal-structural water, carbon dioxide of both organic and inorganic origin. In addition, the temperature of interlayer water and CO_2 MS peak of CN1 is higher than CW1 revealed that organic matter may influence the output temperatures of inorganic products. What's more, using the mineral data and MS results could construct the relationship between organic-free mudstones and organic-rich mudstones. The quantitative analysis showed the CO_2 content of CN1 of mineral origin is about 11.78%, and of organic origin is about 6%. There is about 3.63% of H_2O released from CN1 and the adsorption water is about 0.08%, other types of water is about 2.55% in total. This work is meaningful for further studying the H_2O content in petroleum source rocks.

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