

5 - 1 Investigation for Gasification Mechanism by structural Characterization of Char

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Abstract

It is very important to clarify the behavior of coal particles and the mechanism of gasification to design the gasification furnace, to select coal species and to decide the minimal operating conditions. One of the useful approach to investigate the behavior of coal particles in the furnace is to utilize a char which is a product or a reaction intermediate of gasification as a probe to elucidate the mechanism of gasification. In this work, the analytical methods employed to the characterization of a char are briefly explained and examples for detailed results are described. These include characterization of carbon by a high resolution solid state ^{13}C -NMR and laser Raman spectroscopy, and evaluation of surface concentration of volatile elements due to re-condensation by secondary ion mass spectrometry (SIMS).

High Resolution Solid State ^{13}C -NMR

It has been generally believed that the solid state NMR measurement for a char is impossible and the investigation has been scarcely reported. In this work, however it is demonstrated that the measurement is possible at least for the char made at up to 1500 and structural characterization is possible by FWHM and peak position of chemical shift. The obtained NMR spectra of a SS002 raw coal and chars made at 800, 1200 and 1500 are shown in the Figure.

Laser Raman Spectroscopy

Laser Raman spectroscopy has been well known as a powerful tools for the characterization of carbon structure. It can also be applied to a char and be explained in the same manner as a carbon materials.

Secondary Ion Mass Spectrometry (SIMS)

Depth profiles for elements was obtained on the surface of char particles. Volatile elements (Se, As, F, B etc) are more concentrated on the surface. This indicates that the volatile elements re-condensate on the surface of particles.

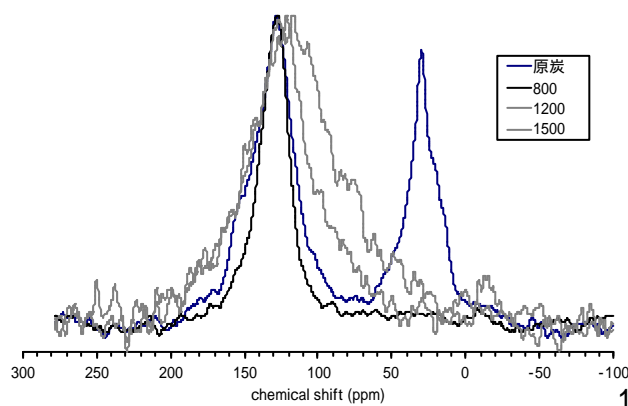


Figure. Solid state ^{13}C -NMR spectra of SS002 raw coal and chars made at 800, 1200 and 1500 .