

Mercury thermospecies in coal: enhancement of mercury removal technologies

Nikolay Mashyanov¹, Sergey Pogarev¹, Elena Panova¹, Vladimir Ryzhov², Nikolay Panichev³,

¹St. Petersburg State University, St. Petersburg, Russia,

²Lumex-marketing LLC, St. Petersburg, Russia

³Tshwane University of Technology, Pretoria, Republic of South Africa

email: nrm@lumex.ru

The mercury concentration in coal varies in a wide range from less than 1 ppb to 300 ppm. Commonly, the total mercury concentration in coal is studied. However, geological processes generate various mercury species in coal and host rocks which can be represented by syngenetic mercury bound to organic matrix; sulfide, silica and carbonate minerals, and by elemental Hg. These species have different matrix binding energy and can be determined by the so-called thermoscanning technique based on the real-time detection of mercury release from a sample during its gradual heating.

The analytical set consists of a standard RA-915M Zeeman mercury atomic absorption spectrometer coupled with a PYRO-915 pyrolysis attachment (Lumex Instruments). Special automated mode of the gradual heating of the PYRO-915 atomizer was developed and optimized to study the mercury thermospecies in coal. In the same run, the total mercury concentration is simultaneously determined. The analysis of various types of coals reveals variously shaped mercury thermospectra. An example is shown in Fig. 1.

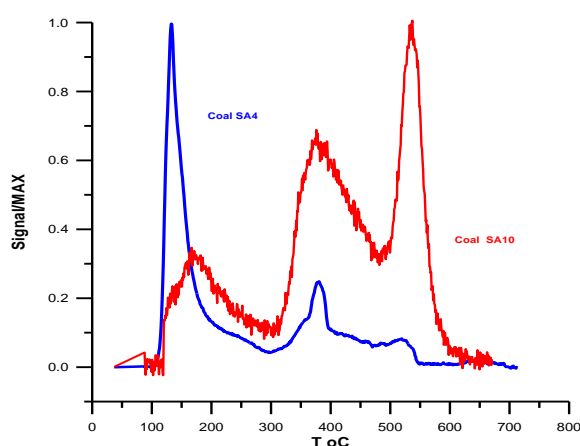


Figure 1: Thermospectra of mercury in bituminous coal from Vaal (SA4, total Hg 540 ppb) and Highveld (SA10, total Hg 195 ppb) coal fields (South Africa).

The low-temperature peaks can be attributed to mercury bound by physical sorption and occluded, and the mid- and high- temperature peaks to mercury bound to organic coal matrix, sulfides, and silicates. The total mercury concentration in the studied coals varies in a range of < 2 ppb to 2 ppm. The technology enables identifying mercury bound to pyrite and other sulfides. The thermoscanning technique gives additional information about mercury speciation in coal. This data can be applied for enhancement of the coal pre-treatment technology to reduce mercury emission to environment.

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