



## DIRECT AA MERCURY DETERMINATION IN COAL

ASTM D6722-11  
EPA 7473

### INTRODUCTION

Mercury is one of the most toxic trace contaminant naturally occurring in the coals. During the coal combustion process at the coal-fired power plants mercury is released into the environment. To manage effectively the stack gas cleaning process, it is necessary to know the mercury content in the coal, and also in stack gas, liquid and solid wastes.

Standard methods of mercury determination in coal using atomic absorption spectrometry (ASTM D6414-14 and ISO 15237:2003) involve preliminary digestion of the sample that takes from 0.5 to 8 hours depending on the digestion conditions, followed by the quantitative measurement using Cold Vapor AAS.

Alternative methods for coal analysis (ASTM D6722-11 and EPA 7473) propose a simpler analysis procedure, namely, thermal decomposition of the sample combined with catalytic conversion, amalgamation and quantitative determination by AAS.

The use of an **RA-915+/RA-915M mercury analyzer** with a **PYRO-915+ pyrolysis attachment** provides fast direct determination of mercury in coal without digestion and intermediate amalgamation.

### MEASURING METHOD

This method of mercury determination in coal is based on the atomization of mercury contained in the sample in a **PYRO-915+** attachment and subsequent mercury determination by flameless AAS in a mercury analyzer **RA-915M/RA-915+**. The interference from the remaining impurity compounds is eliminated due to the high selectivity of the **RA-915M/RA-915+** analyzer with the Zeeman background correction.

### ANALYSIS FEATURES

The proposed method of analysis by pyrolysis shows the following advantages as compared to the common two-stage mercury determination (digestion + AAS or combustion + amalgamation):

- No sample preparation.
- Low limit of detection, high selectivity.
- Wide dynamic measurement range, no "memory effect".
- Monitoring of the nonselective absorption during measurements.
- High analysis throughput (1–3 minutes per sample).
- No need for reagents and carrier gas.
- Systematic errors of analysis are reduced.

### MEASUREMENT RANGE

Detection limit for mercury determination in coal is **1 µg/kg (1 ppb)**.

The upper limit for analysis is **500 mg/kg (500 ppm)**.

### EQUIPMENT AND REAGENTS

The following equipment and materials are used for analysis:

- Mercury analyzer RA-915M or RA-915+ with PYRO-915+ attachment;
- Computer with the installed dedicated software;
- Any certified SRM of mercury.

### PREOPERATIONAL PROCEDURES

**Sample preparation** is done in accordance with the ISO 5069-2:1983 standard; an 0.5–1-mm size fraction from a homogenized coal sample is taken for analysis.

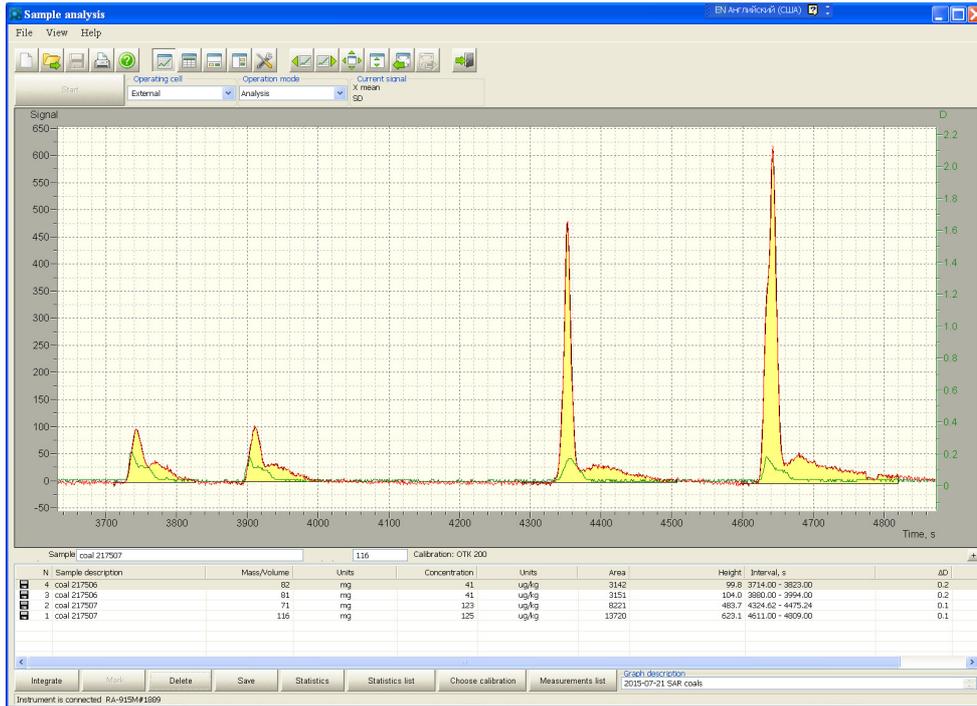
### MEASUREMENT PROCEDURE

Depending on the expected concentration of mercury in the sample, an appropriate heating mode of the PYRO-915+ attachment is selected (slow or fast heating). The sample (50–500 mg) is placed into a quartz dosing spoon, then mercury is thermally atomized in the PYRO-915+ attachment, and the concentration of mercury is measured by flameless Zeeman AAS with RA-915+/RA-915M mercury analyzer using a pre-calculated calibration line. The analyzer is calibrated using a solid SRM or calibration solutions.





## EXAMPLES OF ANALYSIS



### Samples:

coal sample 217506 ( $m_1 = 82$  mg,  $C_1 = 41$  ppb;  $m_2 = 81$  mg,  $C_2 = 41$  ppb),  $C_{av} = 41$ , RSD = 0%

coal sample 217507 ( $m_1 = 71$  mg,  $C_1 = 123$  ppb;  $m_2 = 116$  mg,  $C_2 = 125$  ppb),  $C_{av} = 124$ , RSD = 1%

The information in this leaflet is supplemental. To get more specific information on this method, please contact the developer of this method Lumex Instruments Group.

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