Low-Ash Lignite Analysis using the Spectrolaser

Material: Low-ash Lignite

Gippsland Basin (Australia) lignite deposits have a characteristically high moisture content (50-70%) and a low ash yield (1-3%). The lignite is used extensively for domestic electricity production for which 50 Mt p.a is mined.

Test Method

Five crushed and blended lignite samples were prepared and chemically analyzed using acid extraction (ICP-AES analysis). These samples were used to calibrate the Spectrolaser and then one of the samples was subsequently presented as an unknown five times. Samples for analysis are prepared by placing approximately 5 g of the lignite samples in the sample holder and pressing to 0.3 tone pressure using a LAT hydraulic press.

The analysis time was 20 seconds (all elements) for each sample analyzed..

Detectable Elements

Detectable elements include the principal coal components (C, H, O and N) in addition to the inorganic components Al, Ca, Fe, K, Li, Na, Mg, Si, and Ti.

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Detection Limits

Detection limits were determined from three times the standard deviation in multiple measurements of materials of samples with low analyte concentrations. The estimated detection limits for the principal impurities present in low-ash lignite are:

Element	Detection Limit*
1 °#	0.002 %
Ca	0.002 %
Mg	0.002 %
Fe	0.003 %
K	0.002
Ti	0.003
Al	0.005 %
Si	0.005 %

**Detection limit expressed in % as-received*

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Multiple Analysis Test

All of the following results are expressed as % A.R. (as-received). The moisture content of the test sample was 60% in this case. Some sample heterogeneity was seen in the results with the variances similar to that observed using comparative analysis techniques for this heterogeneous material.

Sample	Al % 309 nm	Ca % 317 nm	Fe % 261 nm	K % 766 nm	Mg % 280 nm	Si % 288 nm	Na % 589 nm	Ti % 325 nm	* S %
1	0.056	0.068	0.060	0.003	0.12	0.11	0.084	0.001	0.39
2	0.048	0.064	0.060	0.003	0.07	0.08	0.072	0.001	0.38
3	0.044	0.060	0.056	0.003	0.09	0.09	0.076	0.0004	0.38
4	0.044	0.052	0.040	0.002	0.08	0.10	0.080	0.001	0.38
5	0.044	0.064	0.064	0.003	0.12	0.08	0.080	0.0004	0.40
Mean (SD)	**0.048 (0.004)**	**0.060 (0.004)**	**0.056 (0.01)**	**0.003 (0.0002)**	**0.10 (0.02)**	**0.09 (0.01)**	**0.080 (0.004)**	**0.001 (0.0005)**	**0.38 (0.01)**
Standard# Analysis	**0.048 (0.004)**	**0.064 (0.004)**	**0.06 (0.002)**	**0.003 (0.002)**	**0.08 (0.005)**	**0.08 (0.005)**	**0.076 (0.006)**	**0.002 (0.0002)**	**0.39 (0.02)**

* sulfur is determined by chemometric correlation to the other detectable components.

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Long Term Performance

Spectrolaser instruments have been installed in commercial lignite-fired power plants and have been operated routinely over a two-year period. Comparison of the Spectrolaser performance to traditional acid-extraction AAS analysis has shown excellent agreement for lignite impurities such as Na, Al, and Ca.

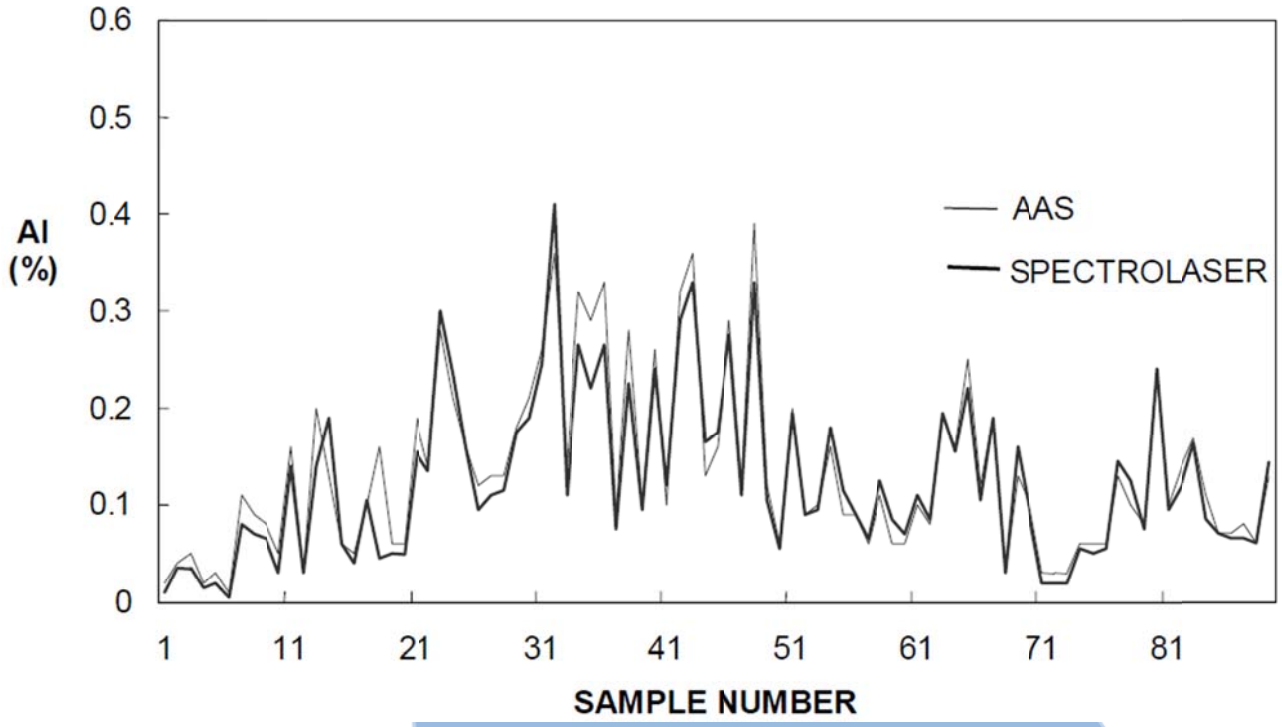

Figure: Daily sampling over a one-month period showing the comparison between the concentration of aluminum measured in coal by both AAS and Spectrolaser analysis.

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