**DIRECT SOLID SAMPLE ANALYSIS USING A MODERN DC-ARC-OES INSTRUMENTATION**

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**DC-arc: principle of operation**

Evaporation and excitation of the sample in a graphite-carrier-electrode by an arc-plasma under a shielding Argon-flow. Optical coupling to nearly any (simultaneous) OES-spectrometer by a UV-stabilised fibre-optic, synchronisation by electronic interface. Integrated microprocessor-control with graphic LCD-display for power and gas-flow. Electrode-gap adjustable (also while operation), bright focusing-screen for a good observation of the process.

**DC-Arc Spectrometry of Sediments**

The experiments show the analytical possibilities in solid sample spectroscopy using dc-arc-OES. By separation of the integration-intervals for low-medium and highboiling elements by a suited current- and gas-control (Ar resp. Ar/O2) good results are achievable in a easy way. The method is demonstrated with time-scans for the examples Zn and Pb (low boiling) and Cu, Cr (high boiling). The concentration depending peak-areas (intensity versus time) are documented for Pb and Zn.

**The Used Calibration Techniques**

*Standard Addition (sample dilution):*
   - different behavior of diluted standards and solid samples in the heating process

*Standard Reference Materials:*
   - available only in a small range of concentrations

*Different Weights of SRM:*
   - the only correct final solution; the same matrix and the same behaviour of analytes

**Experimental setup for dc-arc-OES:**

Spectrometer: GDS-750, Leco Technik GmbH Vacuum-Polychromator (Paschen-Runge configuration), 39 elements, Argon rinsed.
- Spectral data: Focal distance: 750mm, spectral range 150-456 nm, lin. dispers. 0.55nm/mm
- Signal detection: Photon multipliers, up to 1000 measurements/sec/element
- dc-arc-unit: Jarrell Ash Fischier scientific, modified with fibre-optics, Power supply: P. Perzl, Spectral Systems; current 1,5-30 A, computer-controlled; electronic gas control

**Concentrations of used standards**

<table>
<thead>
<tr>
<th></th>
<th>BCR277</th>
<th>BCR280</th>
<th>BCR320</th>
<th>NBS2704</th>
<th>GSD5</th>
<th>GSD9</th>
<th>SL1</th>
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<tbody>
<tr>
<td>Cr</td>
<td>192</td>
<td>114</td>
<td>138</td>
<td>135</td>
<td>70</td>
<td>85</td>
<td>104</td>
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<tr>
<td>Cu</td>
<td>102</td>
<td>70.5</td>
<td>44.1</td>
<td>96.6</td>
<td>137</td>
<td>32.1</td>
<td>30</td>
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<tr>
<td>Ni</td>
<td>43.4</td>
<td>73.6</td>
<td>75.2</td>
<td>44.1</td>
<td>34</td>
<td>32.3</td>
<td>44.9</td>
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<tr>
<td>Pb</td>
<td>146</td>
<td>80.2</td>
<td>42.3</td>
<td>161</td>
<td>112</td>
<td>23</td>
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<tr>
<td>Zn</td>
<td>547</td>
<td>291</td>
<td>142</td>
<td>438</td>
<td>243</td>
<td>78</td>
<td>223</td>
</tr>
</tbody>
</table>

**Conclusion:**

DC-arc in connection with a modern ICP-OES is a very sensitive and fast method in routine analysis. Precision and reproducibilities are convincing. Commercial add-on-instruments with modern technology are an excellent completion of the possibilities of a good simultaneous spectrometer. The new optical coupling method of the arc to the spectrometer by special fiber-optics makes retrofit easy and gives high flexibility in changing from direct solid sampling to liquid analysis. The fluctuations of the arc on the electrode are partly compensated - this results in better RSD’s.

The presented results demonstrate the easy possibilities of dc-arc. The found limits of detection were less than 1-20 µg/g dependent of analyt, less than 10% RSD are possible. The field of applications ranges over nearly all solid samples, from simple qualitative tests up to trace-analysis. Examples are ceramics, metals, glasses, geological and environmental samples.

A major advantage of dc-arc is the complete absence of memories.