

### **New techniques for reflectance measurement and maceral counting**

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At the end of 2002, Ruhranalytik, Laboratory for Coal and Environment, encouraged the Technical Office Hilgers to develop a new instrument for reflectance measurement and maceral analysis. Several motives gave rise to this decision.

1. The Prior Company (former Swift) in England stopped the production of automatic point counters and mechanical stages.
2. The microscope manufacturers do not offer special microscopes for coal petrography anymore, but offer instruments without Berek prisms or rotating stages.
3. The variety of new oil immersion objectives is limited and spare parts for the old measuring microscopes has become rare.
4. The spare parts for the old photometric systems become rare or are not anymore available.

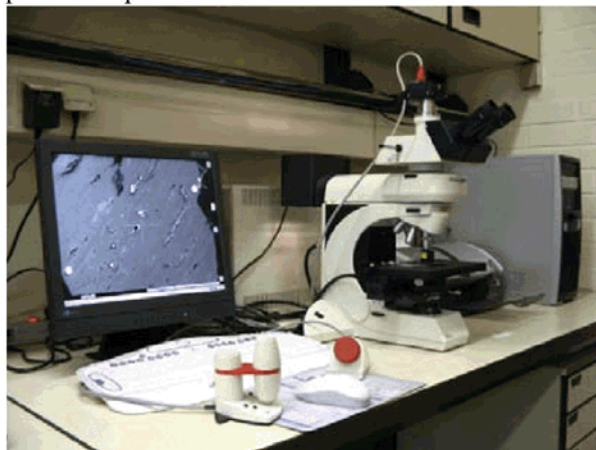
The requirements for the new instrument were to combine maceral analysis and reflectance measurements in one instrument, in order to enable maceral counts without using point counters and to enable manual and, in a later step, also automated reflectance analyses. The time needed for the analyses should be within the limits of analyses carried out with the "old" techniques and the device should be more convenient to handle than the older equipment. Furthermore, counting and measuring procedures should strictly follow the requirements of the standards ISO 7404 respectively DIN 22020.

In April 2004 the new equipment was installed in the laboratory. The complete measuring system comprised a Leica motorized microscope DMLA with Smith beam splitter, adjustable limiters for the field diaphragm and illumination aperture, motorized nosepiece, Leica scanning stage, focus wheel, xyz-manipulator, digital monochrome camera Basler A102F Gamma 1 (15 pictures/s), fire wire connector, computer, printer, LCD-TFT-screen 1280 x 1024, power supply, mouse with focus control and oil immersion objectives 32x and 50x. The software "Diskuss Fossil" for the measurement of reflectance was developed on basis of the Hilgers Diskus program.

Before the device was integrated in the laboratory's daily routine work, numerous samples

of seam coals and blends were analysed and compared with the results obtained 'classically'. The software for the maceral analysis was installed in June 2004 and also checked very thoroughly against results from the point counter method. Some improvements concerning the configuration of the screen window, histogram and the operation of the system were suggested by collaborators of Ruhranalytik during the testing-phase and adopted by Hilgers.

Comparison of results from reflectance and maceral analysis showed no differences in the results from the Hilgers methods and the normal, 'classical' ones. Even the calibration of reflectance standards which requires a high level of accuracy produced perfect results.



**Figure 1.** *The new instrument for reflectance measurement and maceral analysis*

Hence, in July 2004 the new microscope was fully integrated and has been used since then for routine coal petrographic analyses at Ruhranalytik.

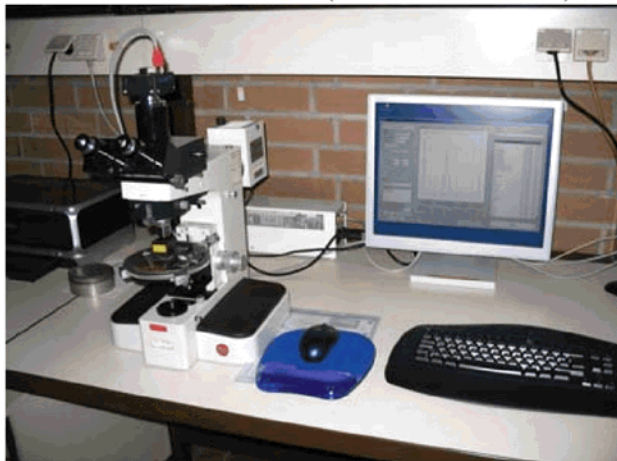
Petrographers who are familiar with the device will perform analyses within the time limits of the "old" working methods but with much more convenience. There is no need to change the microscope because maceral analysis and reflectance measurements can be performed successively. A digital camera shows the live image on screen in full resolution and the measurements can be carried out at any position of the image. The petrographer is able to keep a relaxed physical position in front of the device because the maceral counting is also conducted on screen. Measuring, counting and focussing are done single handed with a computer. The stage is moved automatically to the spacing of gridlines as defined by the petrographer. It is possible to leave the gridline by using a xyz-manipulator but the stage returns to the

grid automatically before a new measurement is made.

Determination of parasitic reflections and calibration of the system before the measurement is done similar to the 'classical' instruments.

The Diskus program also offers the opportunity to save the screen image as photo at any time during reflectance and maceral analyses. Many tools for lettering, indexing and archiving images are available and the photo documents can be used to visualize special observations, for instance in test reports. Moreover, Diskus enables discussions of the live image on screen.

The new measuring microscope was introduced to the participants of the ICCP meeting in Budapest 2004 where the device could be tested and even standards were calibrated (see ICCP News 33).



**Figure 2.** *Orthoplan with new analysis equipment*

In the meantime, Ruhranalytik has replaced one of the older measuring devices fitted on a Leitz Orthoplan microscope. It transpired that older microscopes can be also be easily equipped with the Hilgers fossil system and the results of the reflectance measurements and maceral counting are reliable. The advantage is that one savings of more than 50% of the costs by using the old microscope but it is disadvantageous that an automated stage cannot be installed. Hence, the sample has still to be moved by means of a mechanical stage and focussed manually and the measurement is taken with help of a foot pedal. On the other hand, the old microscope is equipped with a rotating stage, which enables the operator to measure the maximum reflectance.

It is planned to demonstrate the microscope again during the ICCP-meeting in Patras 2005. Up to then the Technical Office Hilgers intends to develop oil-free observation and measurement of

coal samples, improving the image digitally to a degree comparable to oil immersion images. It remains to be seen if the images will be satisfactory, but if so, then petrographic analysis will be significantly advanced.

Petrographers who are interested in the new instrument may directly contact:

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