AUTOMATED MINERAL IDENTIFICATION OF SANDSTONE SAMPLES USING SEM/IMAGE ANALYSIS TECHNIQUES

Theo W. Fens, Jos H.M. Bonnie & William D. Clelland
Shell Research, Rijswijk
(Koninklijke/Shell Exploratie & Produktie Laboratorium)

Abstract A combination of scanning electron microscopy, X-ray analysis and image analysis (SEM/EDX/IA) has been used to perform automatic petrographic analysis of sandstone samples. The methods developed involve the use of backscattered electron (BSE) imaging and X-ray analysis together with image analysis procedures to determine and to quantify the mineralogical composition and grain texture information. The samples to be investigated can be core plugs, sidewall samples or cuttings. Prior to analysis the samples are impregnated with epoxy resin and subjected to high-quality automatic polishing.

The analysis procedure starts with the collection of a BSE image from the SEM, this image is stored in the memory of the image analysis system. Thereafter the locations of the grains and mineral structures in the image are determined and converted to coordinates on the sample surface. The individual grains and mineral structures are then scanned with the electron beam of the SEM. During the scanning of the individual objects, X-rays are generated, and these are detected and analysed in terms of their elemental information. This information is subsequently used to identify the mineralogical composition of these objects. An image is generated in which the composition of the individual grains and

mineral structures is indicated by a colour code. Finally, image analysis is used to quantify the amount of the various minerals present and the geometry of the grains and mineral structures. The procedures are fully automated and, once set up, can be run without operator involvement (overnight, for example). A wealth of quantitative data can be obtained using this single approach, which provides information useful in many fields of petroleum engineering (such as diagenetic studies and the prediction of (petro)physical properties). An example is given of an application in the area of well stimulation, in which the influence of acid formulation on reservoir rock is studied.