Refractive index determination by the immersion method in industrial and research laboratories

PETER M. COOKE

Microscopy Instruction, Consultation & Analysis, 5807 North Maplewood Avenue, Chicago, IL 60659, USA (pmcooke@earthlink.net)

Many analysts working at environmental, forensic and governmental laboratories using polarized light microscopy and the immersion method do not have all the required training in optical crystallography and optical mineralogy, yet seek accurate and efficient means for measuring refractive indices of a wide variety of materials.

Based on extensive interactions with personnel in those laboratories, the author presents a detailed review of the means with which those laboratories carry out refractive index measurements by comparing the instrumentation, techniques, advantages and limitations of the use of central and annular stop dispersion staining (focal masking), dispersion colors, Becke lines, oblique illumination, phase contrast dispersion, and critical darkfield dispersion staining.

Modeling optical properties

BRIAN J. COOPER

Geology Program, Sam Houston State University, Huntsville, Texas 77340, USA (bio_bjc@shsu.edu)

The polarizing microscope is often used for quick and inexpensive determinitive purposes. Modeling optical properties plays an important role in expanding the utility of optical methods. The ultimate goal is the ability to predict the optical properties for a given set of atoms arranged in a particular pattern. It is also desirable to model the effects of substituting other atoms into the arrangement. The equations and graphs derived from the models are then used by mineralogists and petrologists to determine chemical and/or structural parameters based on measured optical parameters.

Various means have been used to model these properties. Gladstone-Dale constants (Bloss et al., 1983) and electronic polarizabilities (Abbott, 1993, 1994), for example, have been used to model individual mineral optical properties or the optical properties of a mineral series. Hauser and Wenk (1976) developed a way to model the optical properties of composite minerals.

My work has been an extension of the electronic polarizability modeling of triclinic and monoclinic minerals by Abbott (1993, 1994). The ability of the computer program written by Abbott has been expanded to handle larger unit cells such as those of zeolites and amphiboles. Part of this work includes the refinement of a working set of polarizabilities for complex silicate structures. The difficulty associated with this refinement process has been the low abundance of well-characterized mineral data. The ideal data set includes data from the spindle stage method of Bloss (1981), a single-crystal X-ray diffraction study, and an electron microprobe analysis of the same grain. The best case scenario would be a "working set of polarizabilities" that takes into account variations in the electronic environment around each ion that occurs in different crystal structures. Progress is being made, but there is a long way to go.

References

Abbott, R. N. Jr. (1993) *Am. Mineral.* **78**, 952-956.

Abbott, R. N. Jr. (1994) *Can. Mineral.* **32**, 909-918.

Bloss, F. D. (1981) Cambridge University Press.

Bloss, F.D., Gunter, M., Su, S_C. and Wolfe, H.E. (1983) *Can. Mineral.* **21**, 93-99.

Hauser, J. and Wenk, H.-R. (1976) *Z. Kristallogr.* **143**, 188-219.