BOOK REVIEW

LUMINESCENT SPECTRA OF MINERALS: REFERENCE-BOOK. by Boris S. Gorobets and Alexandre A. Rogojine. All-Russia Institute of Mineral Resources (VIMS). Moscow, 2002. 300 pp. Softbound $89. (http://www.minbook.com)

In their *Luminescent Spectra of Minerals*, Boris S. Gorobets and Alexandre A. Rogojine present one of the more systematic and comprehensive compilations of luminescence spectral characteristics of minerals, contemplating the spectra of photo-, X-ray-, and cathodoluminescence of 320 mineral species. No comparably extensive reference volume can be found in the up-to-date literature on the subject.

Part I aims at giving an overview of the various luminescence properties found in mineral species on Earth. The authors have achieved this goal, providing the reader an extensive guided tour of the subject. Their review of luminescent substances in nature is carried out at the following systematic levels: (a) global luminescent properties of mineral substances found in the atmosphere, hydrosphere, biosphere, and lithosphere; (b) geochemical luminescent, or, more properly, photoluminescent anomalies, and (c) the community of mineral species considered on the basis of crystal-chemistry peculiarities that determine their luminescent properties. Because an observer can encounter a spectrum of interferences related to various luminescent systems, it is valuable to have at hand such a comprehensive compilation of essential information on the key luminescent gases of air as well as biochemical and organic substances present in the lithosphere. For example, a researcher may need to interpret spectral lines of nitrogen and oxygen, which interfere with lines of mineral samples in X-ray diagrams; sometimes traces of lichens and other efflorescent films cause photoluminescence on the surface of a rock, and so on.

The authors argue that photoluminescence of minerals is not inherent in the bulk of the mineral stuff in the Earth's crust. The phenomenon of photoluminescence in earth materials is associated with luminescent elements (luminogens), usually represented by transition metals of *d* and *f* groups: Mn, Cr, Ti, Mo, W, REEs, and U. In the geology of ore deposits, these metals are known as "ore elements." They have been accumulated in specific collectors, under the influence of abyssal hydrothermal-fluid processes or surface weathering processes. Photoluminescent minerals can be used to trace the forms of ore bodies that produce halos of luminescent minerals - particularly kimberlites, carbonatites, pegmatites, skarns, and veins; mineral photoluminescence can also be used to define the oxidized zones of some ore deposits and to evaluate placers.

Luminescent properties of apatite, fluorite, anhydrite, calcite, plagiocalse, quartz, and scheelite are depicted versus their genetic peculiarities. In addition, techniques of luminescent mineral exploration and processing are described and illustrated by many examples taken from laboratory and practice.

Part II contains thousands of spectral curves and over three dozen tables, providing an enormous amount of information. The plots and tables depict and quantify the luminescence of more than two thousand samples. All minerals are divided into 25 groups, which are homoatomic minerals (diamond), sulfides, hydrocarbons, halides, and oxy-compounds divided into subgroups corresponding to mineral-forming metals responsible for major luminescent spectral bands: Minerals of sodium, magnesium, calcium, manganese and so on up to minerals of uranium. Classical color characterization of the photo-, cathodo-, and X-ray-luminescence of minerals is given, with a number of original data refinements. Emission and excitation spectra of minerals have been conventionally recorded at room temperature and at 77 K. For the most part, the spectra are deciphered, with spectral lines and bands attributed to specific transitions of electrons in luminescent atoms and molecules. Additionally, the decay times of luminescent centers in many minerals are presented.

This book is unique in another aspect: More than two-thirds of the spectral data represent original studies by Russian and Ukrainian scientists, including the authors themselves. As these results have been previously published only in Russian, they have remained largely unknown to English-speaking readers. The authors, whom I have known personally for decades, are widely acknowledged experts in their fields. Backed by their reputation, their spectroscopic data are highly reliable, although, in such a big volume, some mistakes are inevitable and as in any such work, this volume has its share of flaws. For example, there are a number of mineral specimens characterized by one or two spectral curves, without giving specific information on their location, type of mother rock, chemical analysis, and so on. Understandably, the authors wanted to include data on as many mineral species as possible. However, without such information, the value of these analyses is somewhat diminished. Notably, this is a common drawback in many publications. Many spectroscopists in the former USSR came to mineralogy from physics; bringing their prior work habits into the field of mineralogy, they paid no attention to such information. There is also a political aspect to the mineralogical heritage in Russia: Because of censorship in the former Soviet Union, in many instances authors were not allowed to provide the localities of ore deposits in non-classified publications. A more thorough editing of English usage in the translated version of the book would also have been welcome.

Despite the above-mentioned minor drawbacks, the book is an enormous contribution, and its merits easily overwhelm its demerits. I believe that mineralogists and material scientists should have this book as a desk reference, or at least request their library to purchase enough copies to provide easy access to the wealth of information this book offers. Its lavish production, large number of spectral curves from all over the world, clear explanation of major ideas, and many other attractive features of make this book an exceptional value for the money. I recommend this book to anyone interested in mineral physics and especially to those who deal with luminescent properties of minerals and synthetic crystals.

LEONID V. BERSHOV
Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry
Russian Academy of Sciences
Moscow, Russia

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