Model LB-1: Applications

Geological Investigation

The Magnetic Barrier Laboratory Separator was introduced to the market in late 1986. Since then it has come into wide use for separating the component species of mineral samples according to susceptibility. In many leading laboratories, it has replaced the Frantz Isodynamic® Separator, which for some fifty years was the leading equipment of the prior art.

In 1984 the United States Geological Survey and the Geological Survey of Canada sent representatives to the Company's offices to observe separations with a prototype Barrier Separator. The representatives of both agencies resolved that they should convert the Frantz Isodynamic Separators they had been using for many years to Barrier Separators. The United States Geological Survey proceeded to organize and lead the project for estimating Atlantic Continental shelf heavy minerals. Geological survey agencies of the Atlantic coastal states, universities and some industries participated in the work.

A paper co-authored by the scientist at USGS who led the cooperative effort, which appears in a comprehensive report issued by the Virginia Division of Mineral Resources concerning investigations on the inner continental shelf of Virginia, describes how the Barrier Separator was used:

> *"The splits retained for mineralogic determinations were separated into magnetic fractions by using a Frantz Magnetic Barrier Laboratory Separator (MBLS). This fractionation was done to reduce the number of mineral species in each magnetic fraction and to facilitate mineral identification and quantification.*
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> *The Frantz Isodynamic Magnetic Separator (FIMS) is a versatile instrument and can produce excellent concentrates of many minerals. Substantial literature has been published on the subject of mineral separations performed with the FIMS [Citations omitted]. The MBLS has a significant advantage over the FIMS in the ratio of magnetic force to field intensity. Material is visible as it enters the field and undergoes separation at the magnetic barrier. These conditions result in better control, superior sensitivity, and greatly reduced processing time."* [2]

Geochronology

At the laboratories of the Geological Survey of Canada Barrier separators are exploiting low paramagnetic and diamagnetic susceptibilities of pyrites, zircon, and other minerals which, for the most part, report as nonmagnetic when processed with the Isodynamic Separator. A Barrier Separator served in a project led by a scientist at Washington University, St. Louis, which resulted in the identification of a rock one hundred million years older than any previously identified.

Diamagnetic Separations

Many of the more valuable elements and inorganic compounds are diamagnetic in a relatively pure state, including, for example, barium, beryllium, bismuth, boron, carbon (including graphite and diamonds), germanium, gold, silicon, zircon and others. Most organic compounds are diamagnetic.

Conventional separators can exploit only ferromagnetic and paramagnetic susceptibilities. The mechanisms of separation common to such devices are based on attracting particles toward magnetized surfaces. In such separators, because magnetic force urges diamagnetic materials away from a region of higher field intensity, they are collected with nonmagnetic residues, which usually include weakly paramagnetic particles.

In the diamagnetic mode, the LB-1 employs magnetic force to deflect diamagnetic particles at the Barrier, while paramagnetic and nonmagnetic particles follow paths determined by gravity.

A United States producer of high-purity ground quartz uses the LB-1 in the diamagnetic mode for quality control. Samples of quartz that have already been processed in a high intensity, high gradient magnetic separator to remove contaminating minerals by exploiting their paramagnetic susceptibility are separated in the LB-1 by exploiting the diamagnetic susceptibility of the quartz to separate both the paramagnetic and the nonmagnetic contaminating minerals.

The producer of quartz reports that the LB-1 provides separations and concentrations of the contaminating particles which are proportionally about ten times better than the separations obtained with the high gradient, high-intensity separator.

In the Company's laboratory good separations of natural diamonds from cubic boron nitride, which is also diamagnetic, have been made. Relatively pure natural diamonds have been separated from diamonds with inclusions of other minerals.

Leading producers of synthetic diamonds (which range in susceptibility from quite strongly to weakly paramagnetic) are using the LB-1 for classifying and grading, and for separating synthetic from natural diamonds.

2. Grosz, A. E., Berquist, Jr., C. R., and Fischler, C. T., A PROCEDURE FOR ASSESSING HEAVY-MINERAL RESOURCES POT NETIAL OF CONTINENTAL SHELF SEDIMENTS, Virginia Division of Mineral Resources, publication 103, at pp. 13-30 (1990).