

Superconducting High-Gradient Magnetic Separator (SHGMS)

Automated Materials Separation



The Quantum Design Superconducting High-Gradient Magnetic Separator (SHGMS) is a low cost, low maintenance, high throughput system for the value improvement of kaolin (China clay) by magnetic separation. The system is focused around a superconducting magnet, which is cooled via a Gifford-MacMahon cycle cryocooler utilizing “Energy Smart” technology. This system does not use cryogenic fluids, resulting in cost savings, simplified operation and improved safety. The use of HiTC superconducting magnet leads and a persistent mode switch add dramatic cost savings and low energy operation.

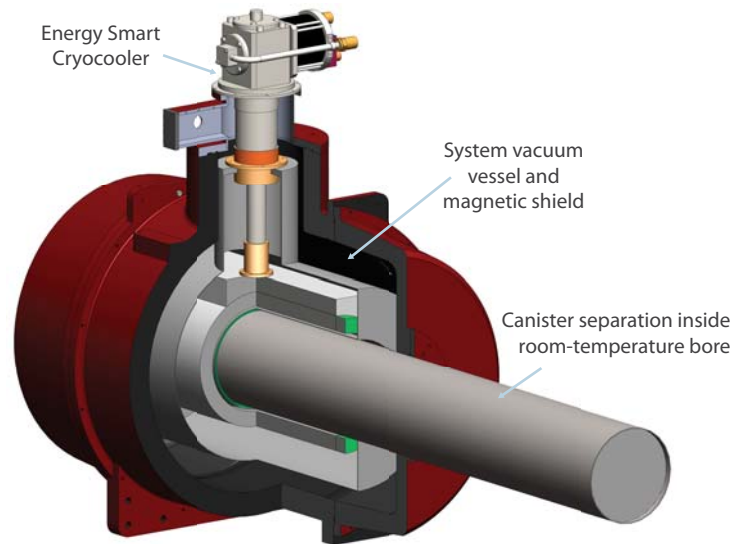
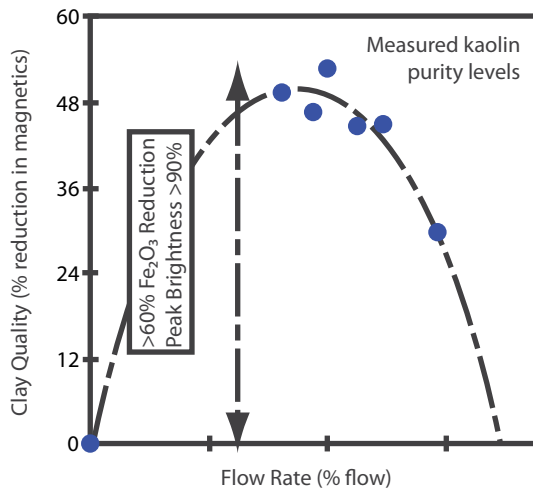
Quantum Design's SHGMS has a small footprint and is designed for modularity so that total processing can be expanded at any time by combining separator units into larger processing networks. This allows for nearly unlimited clay processing. In addition, this modularity provides for the routine maintenance on one component while continuing to process clay using the remaining systems.

Magnetic separators can also become complete processing and characterization centers by adding one of Quantum Design's industry leading, cryogen-free materials characterization systems (such as the PPMS VersaLab).



Unique features of the Quantum Design SHGMS include:

- Superconducting magnet for high clay throughput and processing
- Average magnetic field 6 Tesla over processing volume
- Full **cryogen-free** operation supported by a single “Energy Smart” cryocooler
- Automated, simple to use, computer-controlled system
- High throughput (10,000 -15,000 tonnes per year per magnet – depending on initial clay quality)
- Modular design that allows for expansion of system with continued clay processing during maintenance
- No cryogenic fluids required, and no need for expertise in cryogenic operations
- Electrical costs to cool-down approximately \$30, and \$10 per day to maintain operation (assuming \$0.10 per kWhr)



Magnetic Field: 6 Tesla average field over processing volume (406 mm long x 204mm)

Magnetic Shielding: 10G line - 0.5meters from system.

Power Requirements: 7kW to cool the magnet
3kW for clay processing system

Compressor Power Requirements: With "energy smart" power controls

Water Cooled: 380-480 V; 50/60 Hz, 3 phase, 30A
200-240 V; 50/60 Hz, 3 phase, 50A
Cooling water: ≥4 L/min @ 28°C
Temperature range 4°C to 28°C

Cool-Down Time: <45 hours

Time Between Maintenance on Compressor: 20,000 operational hours

Time Between Maintenance on Cold Head: 20,000 operational hours

Clay Processing Throughput: 10,000 tonnes per year*

Magnet System Weight: 1 tonne

Frame and Processing Canisters Weight: 1 tonne

Tanks (Full) and Ancillaries Weight: 1.5 tonnes

* Actual throughput depends on clay parameters and desired output quality. The system can be tuned by the operator for best results. Typical values range between 10,000 and 15,000 tons per year.