



SEM/EDS Technique, Reporting, and Sample Policies

The submission of samples for testing constitutes acknowledgment of the information, sample requirements, and financial responsibility of the submitter which are provided in this document.

SEM Imaging: Imaging objective and general material composition (if known) should be included on the submission form. Unless otherwise specified, images are taken of the sample at magnifications that best represent the overall size, shape, and composition of the sample as well as at higher magnifications to show any surface textures or particle sizes. Standard rates include images sent via email or a drop-box for download; reports are only written upon request or included based on a stated objective and will be billed for in addition to imaging.

EDS Chemical Analysis: Objectives for EDS testing must be stated in the sample submission since the approach and technique used is dependent upon the testing objective. Receipt of samples without a clear testing objective will delay testing. Reports are charged for based on the time spent to compile the EDS data.

General Sample requirements:

- Samples must be dry and safe to introduce into a vacuum environment (no volatiles). Samples that are received wet/damp must be dried prior to analysis. If air drying is insufficient, the sample(s) must be oven dried at a suitable temperature to remove all liquids and an oven drying fee will be applied. Drying may affect the sample and results, depending on the testing objective.
- There is no general minimum requirement for sample quantity as long as there is enough material to handle.
- Bulk samples must be able to fit or be easily cut to fit into the chamber. Samples with no dimension larger than 4cm will easily fit. Larger samples may fit depending on the surface to be analyzed.
- Imaging and EDS is billed for at an hourly rate. Quotes are issued as estimates based on the provided information and our working knowledge of how long it will likely take to accomplish the objective. If the amount of time required to perform the test is in excess of the quote, H&M will inform the customer prior to conducting further testing and a new quote will be issued to cover any additional time.

Technique Limitations:

- The highest magnification setting on our instrument is 1,000,000x, however, this magnification is only applicable for ideal samples, such as gold deposited on carbon. Generally, magnifications around 20,000x-100,000x are the upper limit for clear imaging of most samples. The resolution of imaging is generally lower at high magnifications if the sample consists of lighter elements.
- Samples that are non-conductive must be coated for imaging. A standard 10-30nm gold coating is applied to non-conductive samples.
- EDS detects the individual elements within the sample but cannot determine the specific compound(s) that those elements may be contained within. The technique provides qualitative or semi-quantitative results. Semi-quantitative results are generally only accurate to within a few percent. The accuracy depends heavily on the sample matrix, flatness of the surface being scanned, homogeneity of the sample, and potential overlap/interference of elements that produce similar peak locations. All EDS results should be considered estimates and may be subject to a higher degree of inaccuracy for the aforementioned reasons.
- Generally, the EDS resolution is best within a magnification range of 50x- 5,000x for differentiating compositional variances in specific regions of the sample.
- The lower detection limit of EDS testing is generally on the order of 0.5%-1% (by weight) for elements heavier than Fluoride, and around 1%-5% for lighter elements (B, C, N, O). Elements lighter than Boron cannot be detected.

Please submit your samples with the required documents to the following address: