Graphite

The unique properties of graphite make it an ideal material for a wide variety of industrial, commercial and consumer applications, including the manufacture of refractories, steel, lubricants, nuclear reactor components, expanded graphite products, and batteries. In recent years, the advancement of purification technologies and lower cost of natural graphite has resulted in a shift in market demand towards the use of natural graphite as a substitute for synthetic graphite in many high-performance applications, such as graphite anodes for lithium-ion batteries.

The increasing popularity of personal electronic devices and electric vehicles has resulted in a surge in demand for high-capacity, rechargeable lithium-ion batteries and the announcement of several new battery production facilities around the world. With increasing demand for supply of superior quality natural graphite, the industry is faced with the challenge of developing innovative strategies to:

- ☐ Consistently meet manufacturer's specifications for high-purity battery-grade graphite, including:
  - Graphite carbon (C_g) content > 99.9 wt%.
  - Spherical particles with average diameter in the range of 10 to 30 micron and "tapping density" > 0.9 kg/m^3.
  - Application-specific requirements for discharge capacity, cycle life and specific surface area.
- ☐ Lower operating costs and increase product yields, and;
- ☐ Reduce environmental impact of graphite refining.

Figure 1: High-Grade Natural Graphite Flotation Concentrate Produced by Thibault & Associates Inc.

Thibault & Associates Inc. takes a proactive approach to meeting the unique challenges of the graphite industry by:

- ☑ Tailoring process development to site-specific resource characteristics, such as:
  - Graphite flake size distribution, occurrence and distribution of impurities with respect to flake size, and deportment of impurities within graphite flake.
  - Assessment of impurity minerals (e.g. quartz, calcite, phyllosilicates, clays, metal sulphides and metal oxides) relative to selection of a reagent scheme and flowsheet for primary beneficiation and upgrading to C_g > 99.9%.
  - Consideration of alternative flowsheets for processing of larger and finer flake size fractions.
- ☑ Developing customized, low-temperature chemical purification processes for graphite based on optimized reagent selection relative to impurities, recycling of reagents and recovery of saleable by-products;

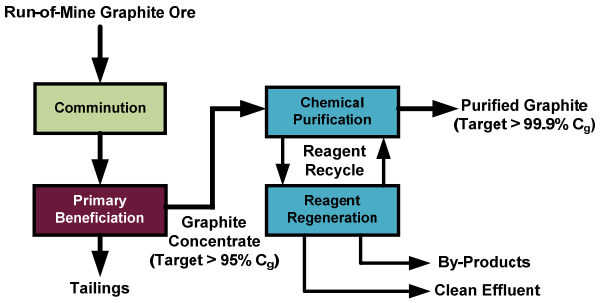


Figure 2: Thibault & Associates Inc. Approach for Chemical Purification of Graphite to > 99.9% C_g

- ☑ Conducting optimal process development in conjunction with a Dynamic Economic Model (DEM) to:
  - Identify measures to improve on economic viability, and;
  - assess cost-benefit trade-offs for staged upgrading of concentrate.

Using this approach, Thibault & Associates Inc. have developed customized purification processes that have achieved greater than 99.95% C_g purity using sustainable chemical purification technologies.

Your Vision - Our Innovation™

For over 28 years, **Thibault & Associates Inc**. has applied process technology innovations to comply with our client's project development strategies, transforming natural resources to high value concentrates, ultra-pure metals, speciality chemicals, transportation fuels or power generation.

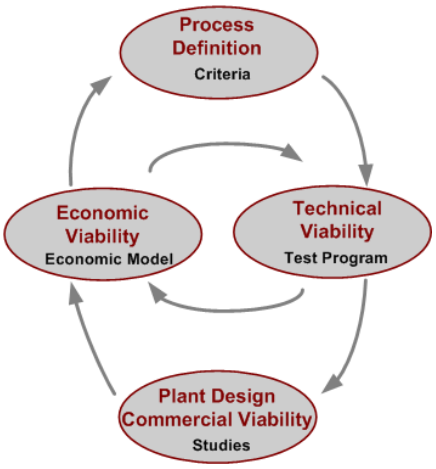
Services

Our firm defines process technology based on the project's earning potential and compliance with product market specifications, environmental protocol and social factors.

We tailor develop process systems to support our client's business plans and our test programs are managed to quantify technical – process design parameters.

As an integral part of process development, we prepare economic models to assess the impact of technical parameters on the project's earning potential.

Our integrated technical and economic studies are based on fully defined process chemistry, equipment selection and plant layout for life of project, heavy industrial process control measures, cost assessment standards, construction and operating practices.



- ✓ Feed characterization and development of process chemistry.
- ✓ Bench scale and pilot test programs.
- ✓ Process simulation and dynamic economic modelling.
- ✓ Independent NI 43-101 technical / economic assessments and feasibility studies.
- ✓ Detailed engineering / multi-discipline plant design, commissioning and aftercare programs.

Speciality

Our clients range from investment firms to heavy industrial producers of base metals, industrial minerals, specialty metals, inorganic chemicals, power, transportation fuels and petrochemicals.

Our project experience covers a wide range of commodities, including:

- ✓ Base metals (Cu, Pb, Zn)
- ✓ Precious metals (Au, Ag)
- ✓ Platinum group metals (Pt, Pd, Rh, Ru, Ir, Os)
- ✓ Oxide metals (W, Sn, Fe, Ti, Al, Cr, Sc)
- ✓ Metals for electronics (In, Y, REO's, Te, Ga, Ge)
- ✓ Specialty chemicals (Sb, V, Mg, K, Si)
- ✓ Battery-grade elements (Graphite, Li, Co, Mn)

In addition to our technical and economic assessment of production opportunities for various commodities, we have specialized in GAP analysis, independent assessment of process development test programs and the transfer of test program data for commercial process plant design, procurement and definitive engineering.

Our most recent graphite projects include:

Assessment of Column Flotation Operating Parameters
New Brunswick Graphite

Development of Refining Process- Graphite Electrodes
Gulf Resources Inc.

Assessment of Flowsheet developed Test Data
Albany Graphite

Assessment of Purification Technologies – Battery Grade Various Graphite Developers

Development of Chemical Refining Process Technology
Great Lakes Graphite

Development of Refining Process Economic Model
Various Graphite Developers

Thibault & Associates Inc.
Applied Process Chemical Engineering
330 Alison Blvd
Fredericton, New Brunswick
Canada, E3C 0A9

Phone: (506) 454-2359
www.thibault-process-engineering.ca