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- IR and fluorescence spectrophotometers
- *Karl-Fischer* titrator
- *Kjeldahl* digestors
- HPLC with UV/VIS and diode-array detectors
- GC with FID, NPD, FPD, and ECD detectors
- AAS with burner, graphite furnace or mercury/hydride system.

Microbiology applied to pharmaceutical products, alimentary products, water for domestic or industrial uses, waste water or bathing water completes the analytical service that *LA* provides to industries and more in general to customers.

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# *Lonza G+T**

## Synthetic Graphite Powder, a Product from Tessin

### 1. Introduction

*Officine del Gottardo* founded in 1908 and located in Bodio (Tessin) began in 1916 the production of Silicon Carbide and later synthetic graphite powder by means of large quantities of electricity consuming *Acheson* furnaces. *Officine del Gottardo* used to be a wholly owned company of *Lonza AG*. In 1989 the plant was merged with the *Lonza Graphite Centre* in Sins (Argovia) to establish the new firm *Lonza G+T*. Since 1994 it belongs to the French group *Imetal*. As a consequence the company will change the name again in the near future. The former *Officine del Gottardo* is one of the biggest plants in the world for the manufacturing of synthetic graphite powder. Thousands of tons of graphite find their way to North and South America, Japan, China, Australia, South Africa, even India and Pakistan to serve a purpose in the daily life. In 1993 *Lonza G+T* was certified to comply with the ISO 9001 standards.

The following article is not only dealing with some aspects of the manufacturing of synthetic graphite powder but it will describe also some applications and a short description of the most important characteristics. It will, however, not focus on the fundamental physical and chemical properties of graphite since they can be gathered from a variety of literature [1–3].

### 2. The Various Forms of Graphite

Graphite occurs in many different forms:

- as powder of flake mined from the earth and purified, referred to as natural graphite
- as powder synthesized in high temperature furnaces, referred to as synthetic graphite
- as graphite parts such as graphite electrodes, moderator blocs, seals and bearings crucibles or refractory plates.

Synthetic graphite consists of polycrystalline polygranular graphitic carbon. An extended heat treatment combined with carefully selected raw materials results in a graphite of not only purity and almost perfect crystalline structure but also very high consistency and predictability; in the market referred as *Lonza Graphite*. The unique combination of various properties makes this 'black material' very useful for a variety of applications.

### 3. The Use of Synthetic Graphite in the Daily Life

Synthetic graphite powder is not only environmentally harmless and nontoxic but it has exciting characteristics such as self lubrication, electrical and thermal conductivity, chemical inertness, (with some exceptions) up to several hundred degrees, and serves as a host for intercalation reactions. The following few examples demonstrate the very useful behaviour of graphite. Very often not only one but several properties are required so as to meet a certain performance.

#### 3.1. *Lubrication Properties*

Synthetic graphite powder found its place as a *friction modifier* so as to prevent blockaging, to reduce wear and to enable a smooth breaking. In addition graphite reduces the noise of breaking remarkable.

Engineering parts containing synthetic graphite as an additive provide excellent *self lubricating properties*. Water meters for example determining the water consumption of a household include such products.

#### 3.2. *Electrically Conductive Properties*

Synthetic graphite powder serves in primary alkaline batteries as an *electronic conductor* and compaction additive in the positive electrode. The requirements regarding purity of the graphite became even more stringent when the battery industry successfully developed the mercury free alkaline cell.

An equipment very often used in a household is the dust cleaner. The specifications for the electric motor of the air ventilator and the carbon brushes accordingly are stringent so as to meet the users demand. Synthetic graphite provides the *electric conductivity, the lubrication properties, the hardness, and others* to the carbon brush.

In total more than twenty different applications of the synthetic graphite powder could be discussed. However, a brief description of the manufacturing process might be of interest as well.

### 4. The Manufacturing Process

The manufacturing of *Lonza Graphite* consists basically of *Acheson* furnaces and

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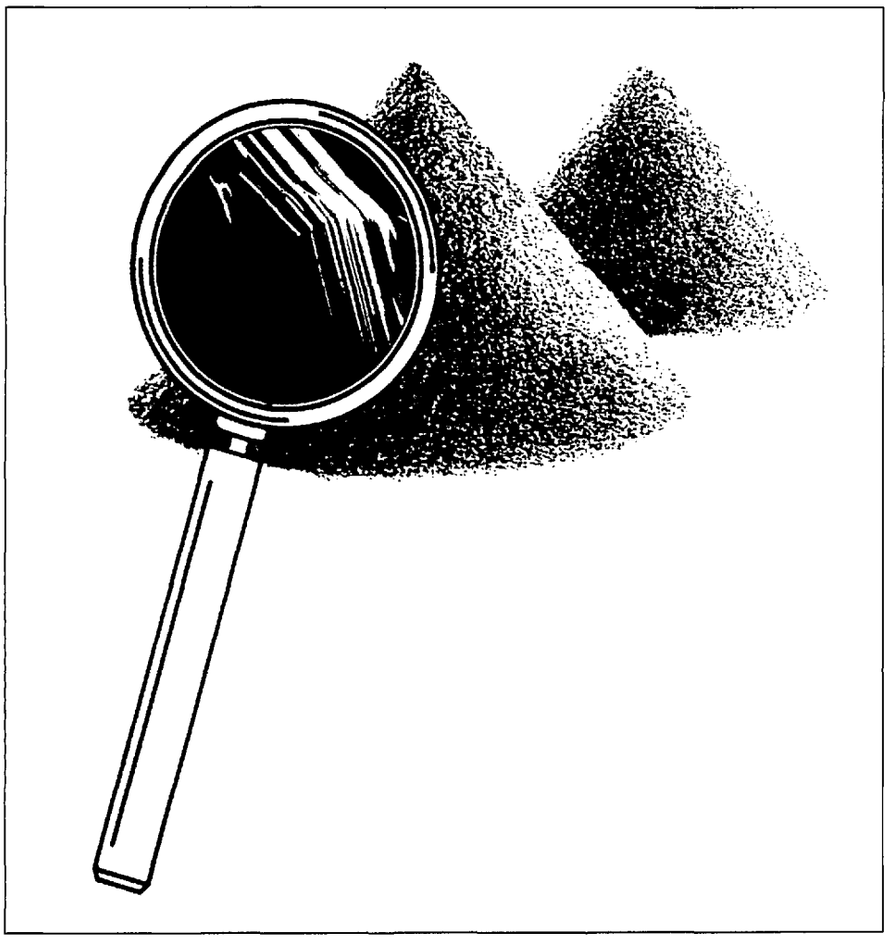

Figure. *Graphite: Scanning electron microscopy (1200x)*

milling and refining systems. The key part is beyond any doubts the big furnaces which are between ten and twenty meter long and *ca.* five meter high. Two big front electrodes are connected by means of a layer of graphite powder. This core is surrounded by specially selected carbons which are to be graphitised. A cover layer of inert material protects the carbon from oxidation. By applying electrical current, the furnace starts to heat up and reaches internal temperatures of up to 3000°. The cooling process lasts several days.

The careful selection of raw materials, the special heating program and the high sophisticated way of assembling the ovens makes the graphite unique in terms of high degree of crystallinity and purity. Thanks to the special cover layer a high yield of graphite can be achieved. The careful in-house development of grinding and refining equipment such as special micronizers and process control devices enables to maintain the purity as well as crystallinity of the raw graphite besides the guarantee of a high consistency. A variety of treatments result in many different graphite powders which are used in over twenty applications.

In order to be able to control and to prove the unique characteristics of the graphites the analytical labs have to be equipped accordingly. Emission spectroscopy or laser diffractometry are only two examples of the high sophisticated analytical methods used.

### 5. Typical Characteristics of Synthetic Graphite Produced in Bodio

The following data of typical characteristics demonstrate the high quality level of *Lonza Graphite*:

| | | |
|---|---|---|
| – | Purity | >99.9% C |
| – | Crystallinity | >98% graphitised |
| – | Real density | *ca.* 2.235 g/cm$^3$ |

[1] P.L. Walker, 'Chemistry and Physics of Carbon' 2,3,4, Marcel Dekker Inc., New York–Basel, 1966.
[2] W. N. Reynolds, 'Physical Properties of Graphite', Elsevier Publishing Co., New York, 1968.
[3] L.C.F. Blacman, 'Modern Aspects of Graphite Technology', Academic Press, New York, 1970.

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