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The Zero-Option technology - History

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Born in 1934 to a numerous family, Leo Nevels saw how after WO II the environment suffered mankind's ill-treatment. He decided he had to take action to stop this global environmental destruction and started studying chemistry at the Technical University of Delft. During his studies he already founded the company Edelchemie and obtained his very first patents.

The initial stages

After finishing his academic career, he worked several years as a high school chemistry teacher. In the meantime he continued his research on the treatment of chemical residues, building many kinds of furnaces and many installations for purifying flue gases. When finally he noticed his research was leading to something important, he quit his job as a teacher and dedicated himself fully to his research. His goal was to develop a technology capable of treating all chemical residues, produced by our modern society, with a minimum environmental impact. This technology he denominated as the Zero-Option technology.

Mother Nature

During his research he was intrigued by how Mother Nature disposes of her own waste. It was in fact the Corona volcano on the island Lanzarote which gave him the idea of how the recycling process in Nature works.
All living organisms are built up from simple raw materials. When these organisms die, a mineralization process is set in motion. The remains travel during many ages until they finally arrive at the bowels of the earth to be melted. Here the matter differentiates into new raw materials, which in due time will return to the surface, where it might be part of a living organism once again. This is truly a marvelous, durable recycling process of matter.

The Zero-Option technology

In his Zero-Option technology Leo Nevels has tried to follow Mother Nature’s steps, albeit at a much faster pace, because the residues are mineralized at a much higher temperature. Processes occurring in the atmosphere served him as an example for how to purify flue gases. The technology was already sufficiently developed in 1989. In 1992 the first patents were obtained in the US, followed by several other patents in Europe, the Soviet Union and Japan. Currently, the Zero-Option technology has been proven in practice for more than 15 years.

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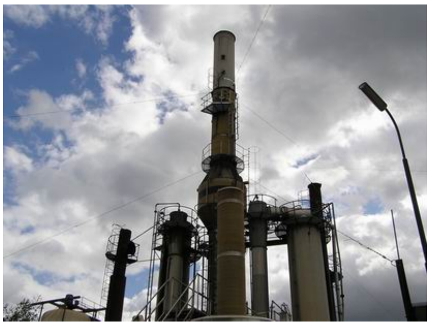
The Zero-Option technology - The process

Residues

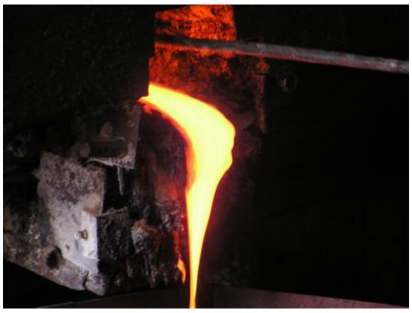
The Zero-Option technology is capable of treating almost every chemical residue of our society. All kinds of residues are carefully mixed, taking advantage of their various properties. This way there is no need for any primary materials. The Zero-Option is very well suited for treating complex residues which do not allow for direct recycling, like e.g. electronic scrap.

Incineration



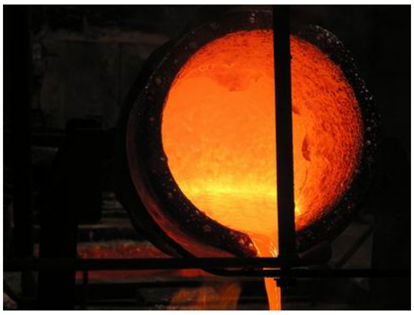
The mixture of residues is incinerated at high temperature in an incineration furnace, in order to destroy all organic components and reduce the whole batch to mere ashes.

Flue gas purification



Produced gases are washed by means of a wet flue gas purification system, yielding minimal emissions of acidic gases, dust and heavy metals. The products formed during the purification process are separated and returned to the incineration process once again.

Melting



The ashes resulting from the incineration process are brought into a melting furnace where the material can separate into various different phases. Formed gases are purified by the aforementioned process. A metal alloy is also formed, as well as a vitreous phase, poor in heavy metals. When this lava is extracted from the furnace, it is quenched, resulting in a black glass: synthetic obsidian.

Purification

The obtained metal alloy is purified through electrolysis into, amongst others, pure silver. Other metals can also be purified into their pure form or into a pure compound.
This way a complex mixture of residues is reduced to a few simple, primary products.

The Zero-Option technology - Emissions

The emissions obtained by the Zero-Option are so low they do not effect the environment in any way. The various kinds of emissions are summarized below.

Air emissions

The air emissions of the melting furnace are shown below. Table 1[1] indicates the emissions of organic components, whereas table 2[2] shows emissions of heavy metals and other gases.

Table 1

Compound	Concentration
Monovinylchloride, benzene, acrylonitrile	<50 µg/Nm^3
Other VOC (C3-C9)	<1.3 mg/Nm^3
Other VOC (C9-C30)	<4 mg/Nm^3
Carcinogenic PAH's	<0.1 µg/Nm^3
PAH dust	<1 µg/Nm^3

Table 2

	mg/Nm^3		mg/Nm^3		mg/Nm^3
CO	11	As	0.003	Ni	0.010
NO_x	44	Cd	0.023	Pb	2.5
SO_2	5.3	Co	0.003	Sb	0.0065
HCl	19	Cr	0.17	Sn	0.058
HF	<0.03	Cu	0.40	Tl	<0.065
Dust	18*	Hg	0.005	V	<0.001
		Mn	0.033		

* isokinetic, gravimetric

Aquatic emissions

The emissions to the municipal waste water treatment plant include dry and wet atmospheric deposition onto an industrial terrain of around 3.5 hectares.[3]

Table 3

	Concentration [mg/L]	Load [kg/yr]
Cu	0.06	1.0
Cr	0.15	2.3
Ni	0.89	13.8
Pb	0.23	3.5
Zn	0.32	5.0
Cd	0.01	< 0.14
Ag	0.15	2.3
Hg	1.78 µg/L	< 0.03

Solid emissions

Solid emissions consist of:
- Pure metals (Ag, Au)
- Metal compounds ($Cu(OH)_2$, $PbSO_4$, $CaSO_4$)
- Salt mixture (NaCl, NaBr, Na_2SO_4)
- Synthetic obsidian

The metal compounds are sufficiently pure to be implemented in the production of new metals.
The salt mixture is very suited for the production of bromine.
Synthetic obsidian is a black glass containing only trace amounts of heavy metals, immobilized in the vitreous matrix. This material is regarded as a primary building material.

[1] Bureau HMO, "Onderzoek emissie organische verbindingen pyrolysesectie Edelchemie Panheel B.V. te Panheel", May 2003
[2] Lisec, "Emissiemetingen lucht Edelchemie Panheel, 11-01-2005
[3] Internal analysis

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The Zero-Option technology - Products

Obsidian

Our synthetic obsidian has various applications as:

- Filler in concrete
- Enamel (fig. 1)
- Decorative stone (fig. 2)
- Source for trace elements
- Raw material for the production of cement clinker

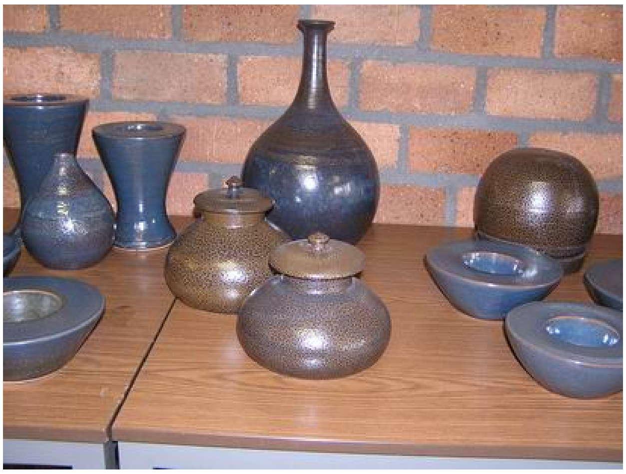

Fig. 1 Pottery with obsidian enamel.

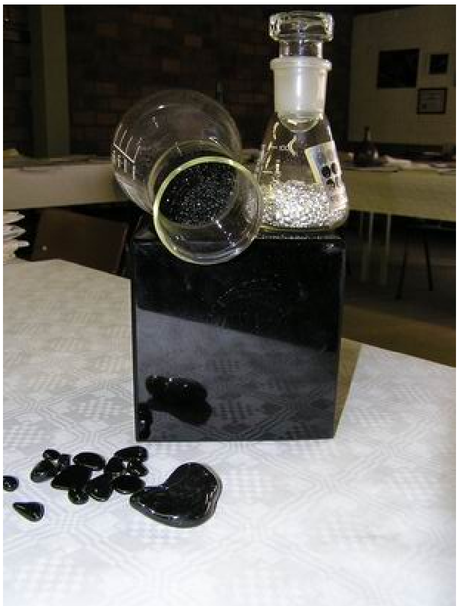

Fig. 2 Ground obsidian, pure silver, massive obsidian block and polished obsidian stones.

Metals

- Pure sterling silver (999)
- $PbSO_4$ for the production of led
- $Cu(OH)_2$ for the production of copper
- Pure gold and other precious metals
- $CaSO_4$ for the production of cement

Salts

The mixture of salts obtained from the melting furnace is rich in NaBr originating from pharmaceutical residues and electronical residues containing flame retardants. This salt mixture is very well suited for the production of bromine, because of its high bromide concentration compared to the concentration found in sea water, which is usually used. This way the bromine cycle can be finally closed.

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