

Recovery of magnesium oxide from dolomite and/or dolomitic refractories using a modernized *bicarbonate* process

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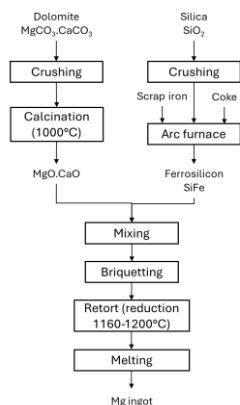
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Context

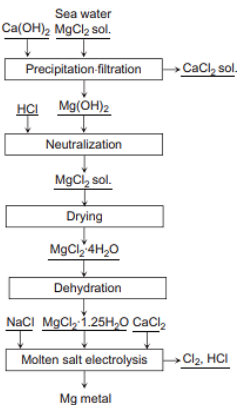
The Freedom project is motivated by developing a magnesium industry, from refractory wastes, to counter Europe's dependence on China. It was initiated by multiple research structures and university : CTP, BCRC, CRM and ULiège. The project comprises two steps: MgO (1) and Mg (2) production. This thesis is developing, in collaboration with CTP, a deep study of the *bicarbonate* process with the actual considerations on raw materials limits and non-emitting industries to produce MgO. The chemical reactions occurring during this process will be studied through dolomite in a first time. After, the dolomitic refractories will be included in the study to show the properties variation and their influence on the reactions.

Mg production methods

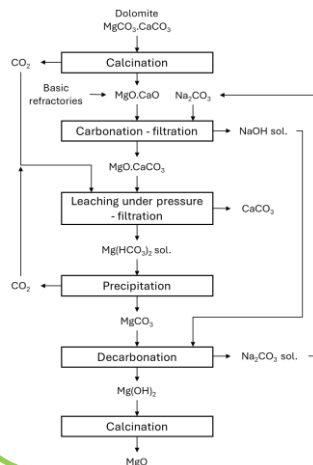
Pidgeon process



Electrolytic process



Bicarbonate process



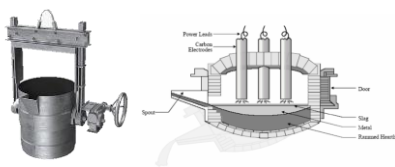
Points of interest

- CO₂ cycles
- Na₂CO₃/NaOH regeneration
- 4 possible products :
CaCO₃ Mg(OH)₂
MgCO₃ MgO
- High purity MgO

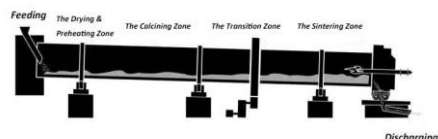
Dolomitic refractories – MgO.CaO

Refractories applications

Steel industry



Cement rotary kiln



Main dolomitic refractories types

- Fired semi-stable dolomite
Binder : Ceramic binding (firing)
Materials : Dolomite or brucite-portlandite
- Fired stabilised dolomite
Binder : Ceramic binding (firing)
Materials : Dolomite - Magnesia - Silica or brucite-portlandite - Magnesia - Silica
- Tar-bonded dolomite
Binder : Tar (organic)
Materials : Dolomite - Magnesia
- Unfired dolomite-magnesia-carbon
Binder : Resin (organic)
Materials : Dolomite - Magnesia - graphite

Chemical composition (wt%)

	Type I	Type II	Type III	Type IV
MgO	36-40	40	43	35-45
CaO	48-52	40	44	43-54
Fe ₂ O ₃	1-3	3	0,4	-
SiO ₂	2-4	14	0,8	-
Al ₂ O ₃	1-2	2	0,6	-
C	/	/	11	6

Calcined dolomite composition (wt%)

	MgO	CaO	Ig. loss	Fe ₂ O ₃	SiO ₂	Al ₂ O ₃
Calcined dolomite	19-21	31-34	45-47	0-0,4	0,1-0,9	0-0,3