The advancement and developing of red mud utilization in China

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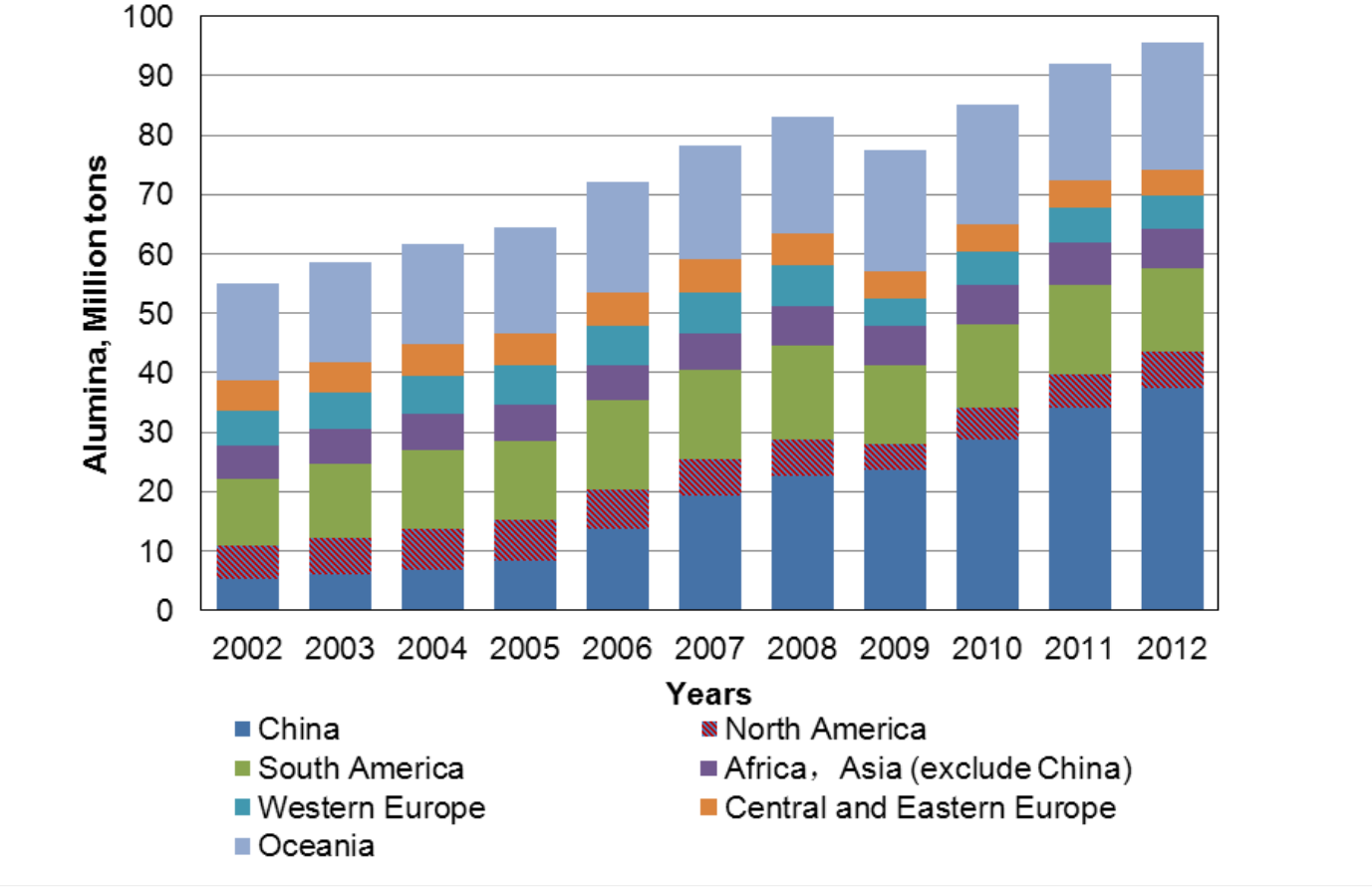
1 Alumina production and Red mud



Alumina production growth in China and the world in the past ten years

1 Alumina production and Red mud

- **Globally:**

  In 2012, the total production of red mud: more than 100 million tons,

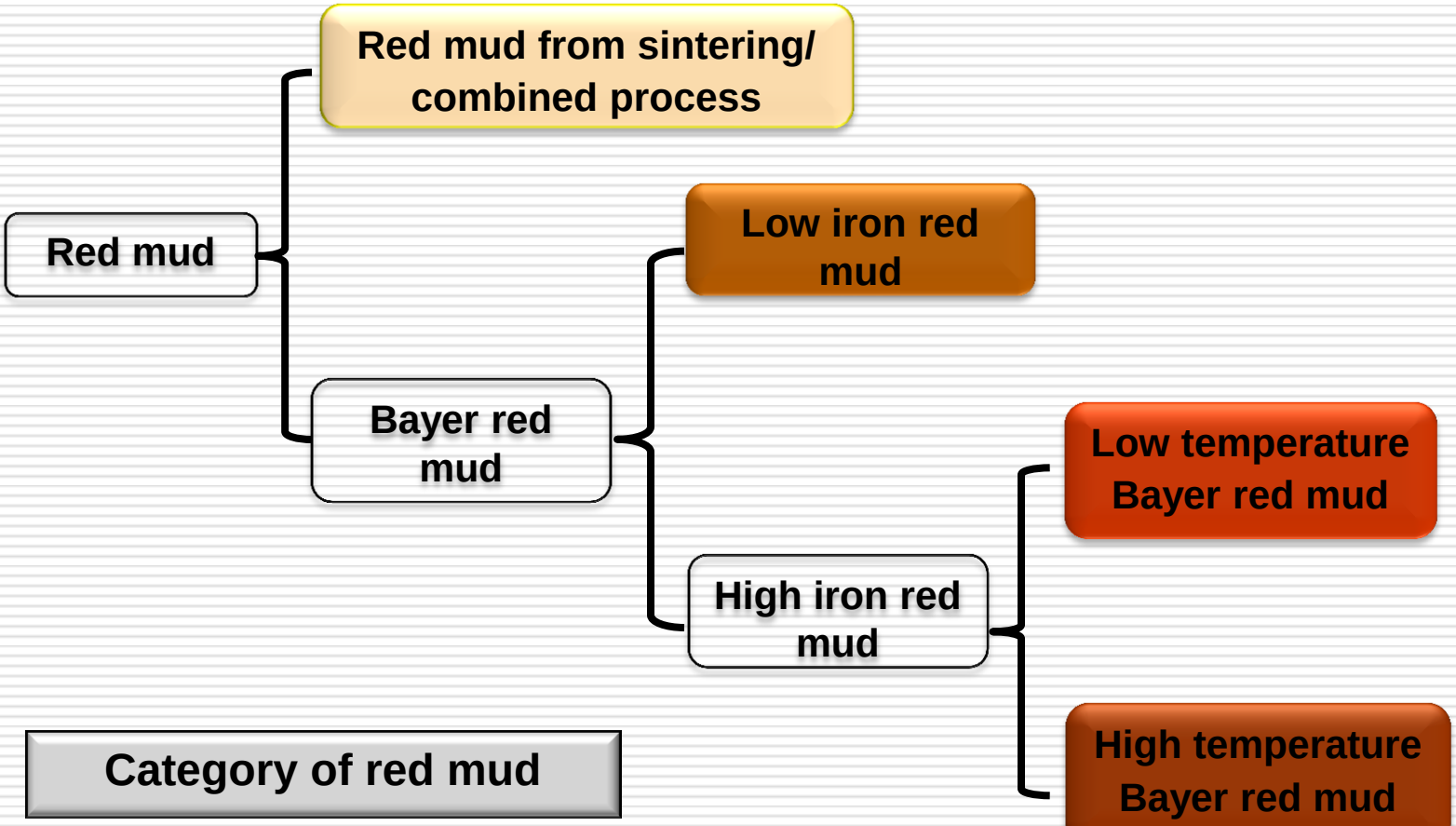
  the cumulative amount: more than 3 billion tons;

- **In China:**

  In 2012, the total production of red mud: over 40 million tons,

  the cumulative amount : more than 250 million tons。

1 Alumina production and Red mud

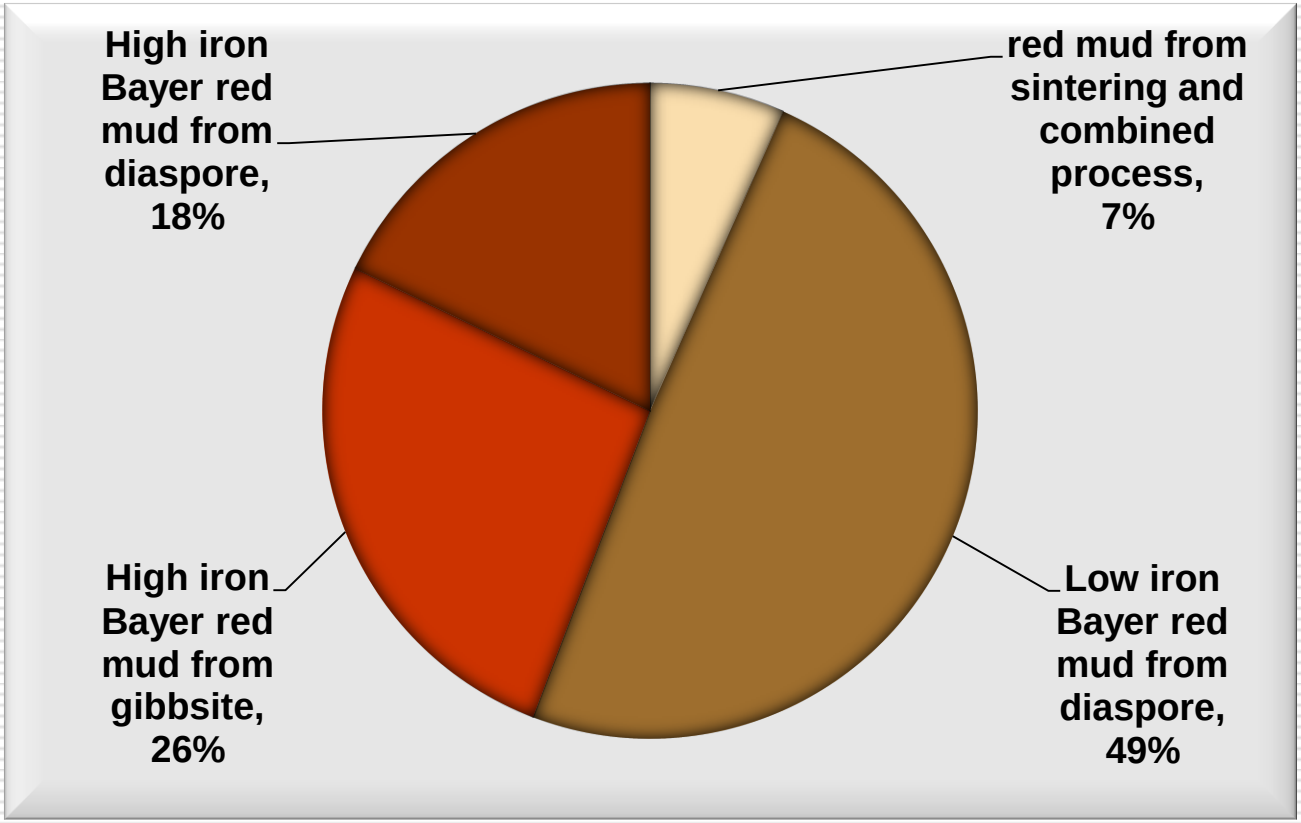


1 Alumina production and Red mud

Chemical composition of representative red mud samples (%)

Process	Bayer Process			Sintering Process	Combined Process
Fed Bauxite	Gibbsite	Diaspore			
		high iron	low iron		
Na_2O	11.34	11.60	5.55	2.80	2.77
MgO	0.48	1.20	1.09	1.70	2.02
Al_2O_3	19.95	16.82	23.97	6.40	8.10
SiO_2	23.71	16.66	17.21	22.00	20.56
K_2O	0.21	---	0.39	0.30	0.35
CaO	2.73	8.86	20.83	41.90	44.86
TiO_2	1.51	4.17	5.96	3.20	5.09
Fe_2O_3	32.04	37.48	10.39	9.02	8.10
LOI	11.40	9.05	7.12	11.70	8.18

1 Alumina production and Red mud



Proportion of 4 kinds of red mud in China

2 Red mud utilization in China

Main utilization directions

No.	Red mud	Direction	Volume	Note
1	sintering /combined process	Building and construction materials	200-250 kt/a	Use red mud directly
2	High iron red mud from gibbsite and diaspore	Building materials (bricks)	1000-1300 kt/a	use the sand separated from red mud
3		Cement	800-1000 kt/a	iron ore separated from red mud
4		Iron & Steel Production	800-1000kt/a	
5	Bayer red mud from China local diaspore	Glass ceramics, glass fibre…	100 kt/a	It will run in the end of 2013.
6		Rare Earth Elements recovery (REE)	/	In research
7	All red mud	Polymer filler	10 kt/a	
8		Environmental protection (exhaust gas and waste water adsorbent)	10kt	In pilot research
	totally		3000 -3600 kt/a	

3 Utilization

—— Red mud from sintering and combined process

☐ Building Materials

- ✓ Larnite is the domestic in the red mud, which is comment contributor to construction.
- ✓ Major products: bricks, insulating materials for furnace, dam construction
- ✓ The efflorscence of product is its weakness.

heat insulating material

Non-fired bricks

3 Utilization

—— Red mud from sintering and combined process

- **Construction Materials**

✓ **Road base material**

✓ **Dam Construction**

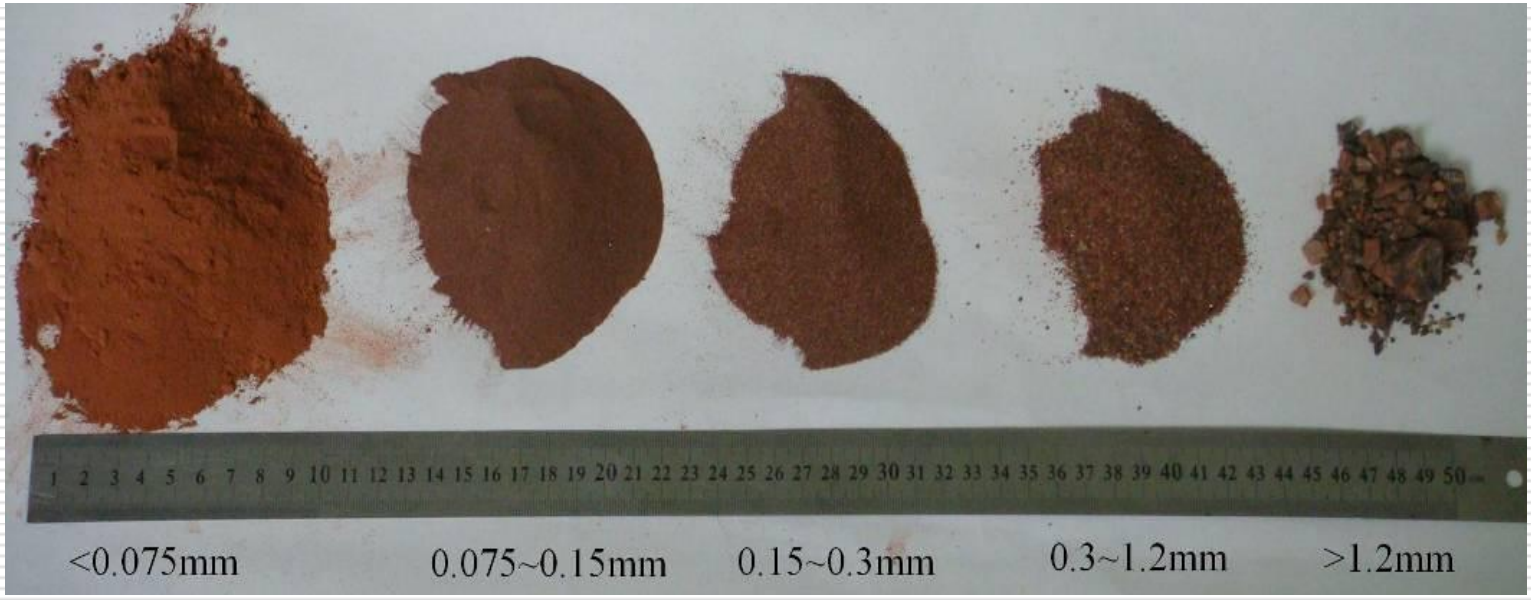
The road built with red mud base

The red mud dam constructed with red mud, use for storing Bayer red mud

3 Utilization

—— High iron red mud from gibbsite and diaspore

- Separating iron and degritting



3 Utilization

—— High iron red mud from gibbsite and diaspore

☐ Separating iron and degritting

Yield of red mud separation

Bayer red mud	Iron		Sand		Fine red mud
	Yield, kg/t red mud	Fe_2O_3,wt%	Yield, kg/t red mud	Fe_2O_3,wt%	Yield, kg/t red mud
Diaspor high temperature Bayer process	60-80	52-57	30-50	44.42	850-900
Gibbsite, low temperature Bayer process	80-130	52-57	100-120	34.69	750-850

Almost all of high iron red mud (15-18 million tons) are treated in this process in China.

3 Utilization

—— High iron red mud from gibbsite and diaspore

Production Site

3 Utilization

—— Low iron red mud from China diaspore

☐ Glass-ceramic

Application: wall and floor tile, Wear-resisting lining

Status: In construction

Advantage : low melting points, large market

Sample of glass-ceramic

The glass ceramic sintering kiln

3 Utilization

—— Low iron red mud from China diaspore

- **Rare Earth Elements (REE) Extraction**

The feasibility of the process depends on the contents of REE in red mud.

3 Utilization

—— Low iron red mud from China diaspore

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☐Rare Earth Elements (REE) Extraction

- ✓ **Present acid leaching - extraction process is defective.**
- ✓ **The environmental and economical extraction process is significant and challengeable.**

3 Utilization —— red mud

☐ Mineral fillers (from red mud or separated red mud)

Application in: plastics, rubber, wood plastic products (substitute of Precipitated Calcium Carbonate (PCC), and white carbon black).

Developing direction: superfine filler, low iron filler

Expected profit: 100-200 RMB/t red mud

Fresh red mud (hydrophilic)

Modified red mud (oleophylic)

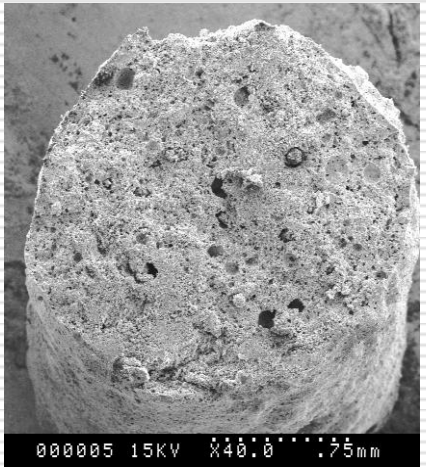
PVC electrical conduit pipe from red mud

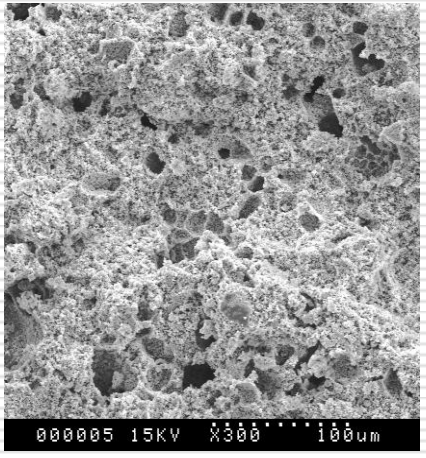
PVC threading pipe and drain-pipe from red mud

3 Utilization —— red mud

☐Absorbent for gas desulfurization

- ✓ The pilot test was completed.
- ✓ Its de-sulfuring efficiency is satisfying.
- ✓ However, the mud is adhensive on the surface of desulfurization facilities, because of its higher density and cementitious property.
- ✓ The application in waste water treatment is in research both in China and oversea.





4 Conclusions & Discussion

Future:

- **High iron red mud**

Magnetic separation technology should be improved for fine weak-magnetic material separation from mud slurry ;

High efficient iron extracting and iron separation technology after magnetization roasting;

Utilization of the red mud after iron separation.

4 Conclusions & Discussion

- **Low iron red mud （About 50% of the total of red mud）**

Environmental REE extracting technology;

Some other methods to consume red mud in large-scale.

Feasible soda removal processes.

4 Conclusions & Discussion

- Almost 50% of research papers on red mud are from China. Others from India, Australia and Greece….
- In China, more attention is focused on industrialization. And some technologies are or in commercial application. This is ahead of the world.
- So, the research center on red mud is in China.
- However, cooperation is absolutely important for the common global problem.

Thank you!

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