BENEFICIATION OF ULTRA-CLEAN COAL

(An Economical Approach for producing carbon for the fuel cell application)

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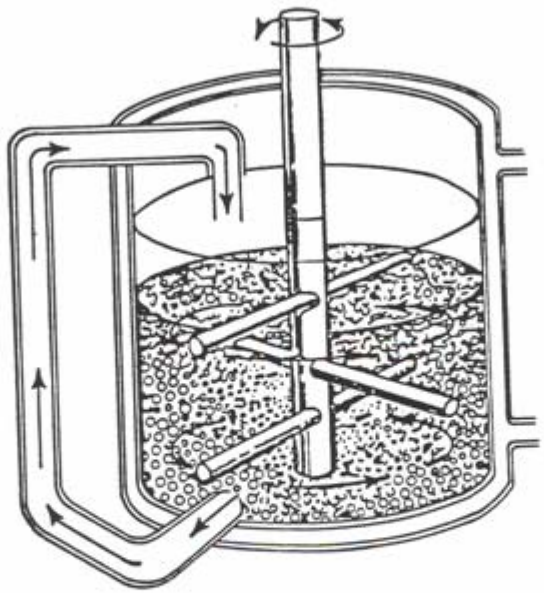
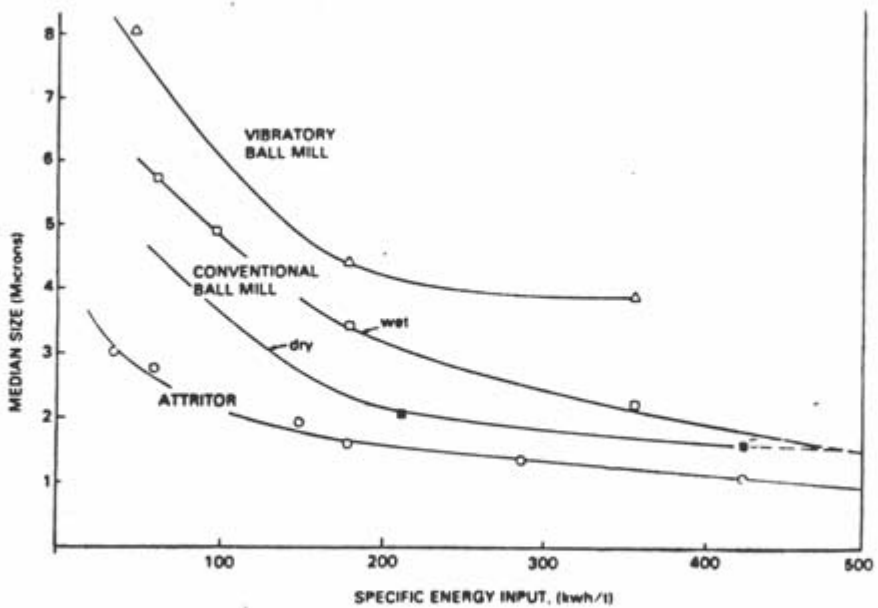
Large Particles/Lumps
Minerals Encapsulated

Pulverized Coal
Minerals Liberated

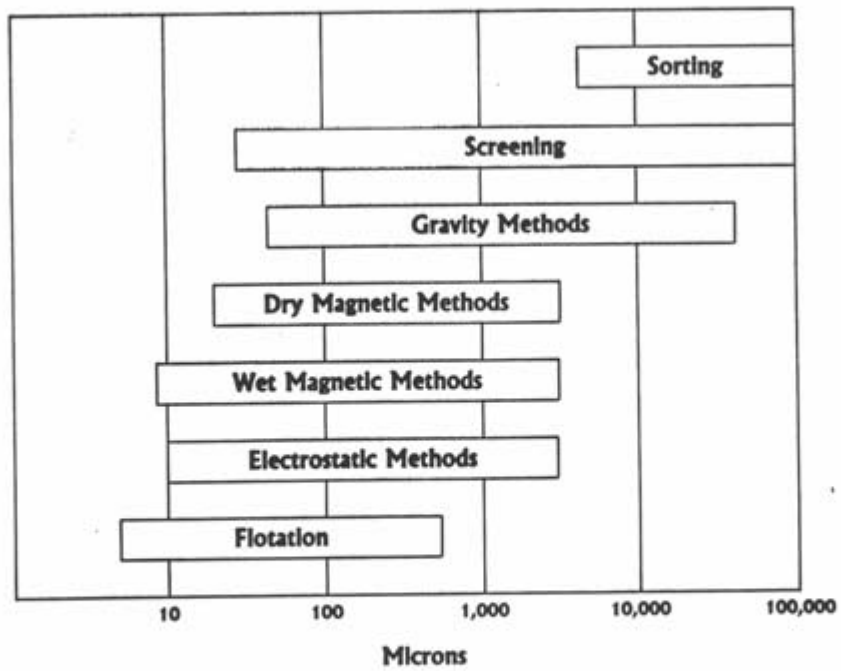
Importance of Liberation



. Sketch of large attritor (Union Process, Inc.).



Comparison of the effectiveness of various grinding devices for the ultrafine grinding of Pima chalcopyrite concentrate. Herbst and Sepulveda, "Fundamentals of Fine and Ultrafine Grinding in a Stirred Ball Mill, Proc. Powder & Bulk Solids Conf., Chicago, IL, May 1978.



Effective range of application of conventional mineral beneficiation processes.

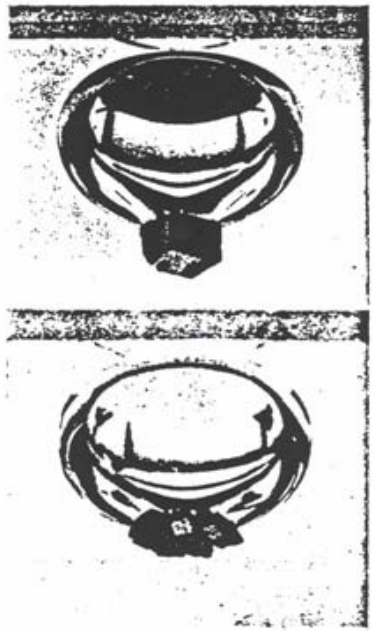


Figure XVIII-8
The adhesion of mineral particles (galena) to bubbles and the formation of aggregates.

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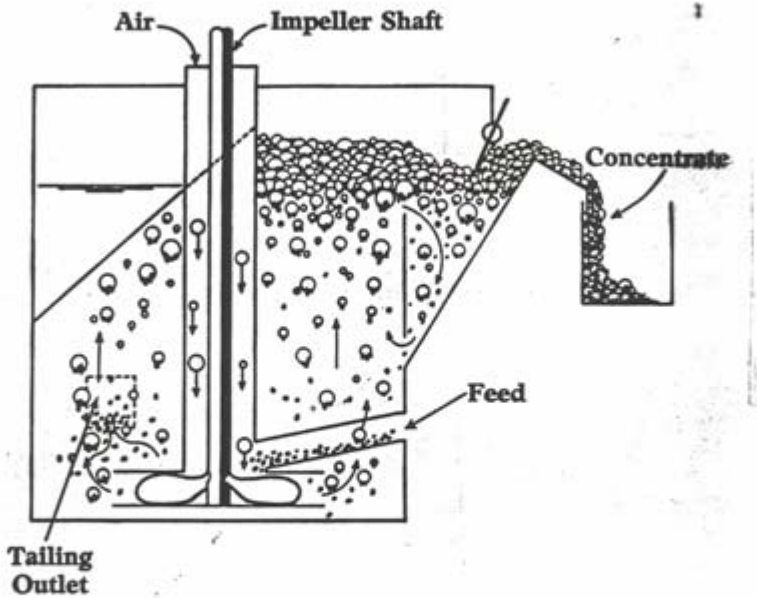
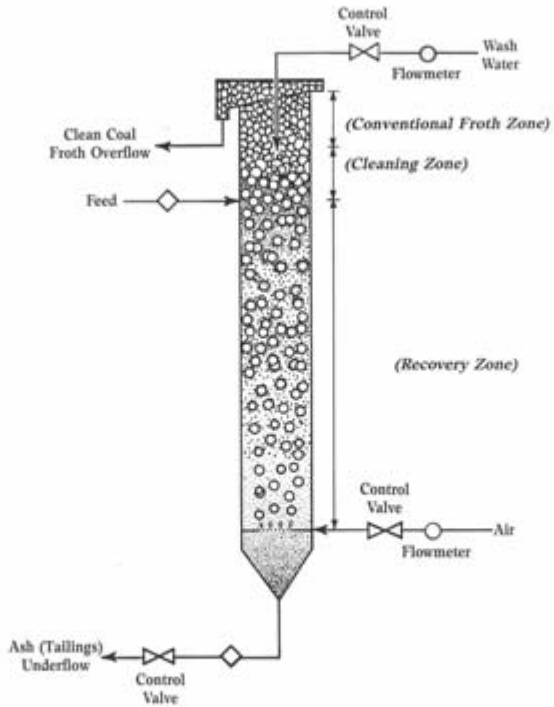


Froth Flotation Cell



Schematic Diagram of Column Flotation System

SELECTIVE AGGLOMERATION

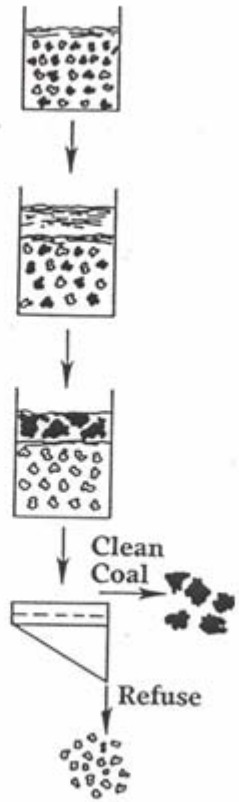
- Grinding of coal to liberate the mineral matter
- High shear mixing of coal slurry and an agglomerating agent (hydrocarbon)
- Low shear mixing to grow size of the coal agglomerates
- Separation of coal agglomerates from the dispersed ash.

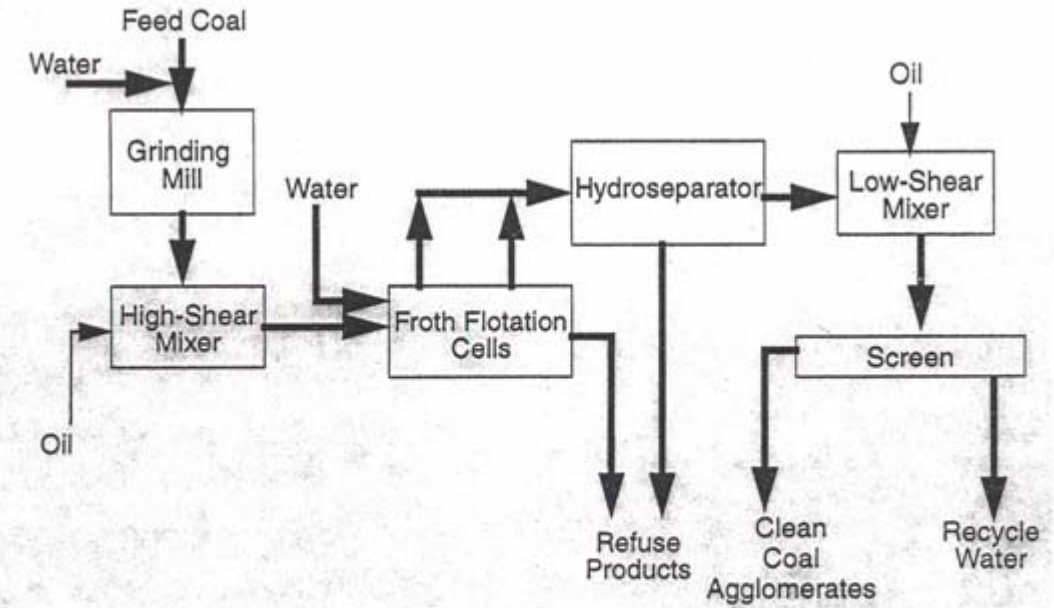
1) Dispersion of ultrafine ground coal

2) Addition of an agglomerating agent and mixing at high speed agitation

3) Conditioning of slurry at low speed agitation

4) Separation of agglomerated coal from ash





Schematic of the single-stage aglofloat process.

CHEMICAL PROCESS (LEACHING)

- Dissolved Oxygen Solution.
- Ferric Sulphate Solution.
- Nitric Acid.
- Hydrofluoric Acid.
- Caustic Solution
- Molten Caustic (equal volume of NaOH and KOH).

ESTIMATED COST OF PRODUCING ULTRA-CLEAN COAL

	Advanced Flotation			Oil Agglomeration			Chemical		
	Ash %	$/t*	¢/lb	Ash%	$/t*	¢/lb	Ash%	$/t*	¢/lb
Coal	~10	30.0	1.5	~10.0	30.0	1.5	~10.0	30.0	1.5
Processing Cost	~ 5-7	12.0	0.7	~2-3	17.0	0.9	~1-2	60.0	3.0
TOTAL COST		42.0	**2.2**		47.0	**2.4**		90.0	**4.5**

*** per ton of clean coal**