FLY ASH AS AN ALTERNATE RESOURCE MATERIAL FOR BUILDING COMPONENTS THROUGH FLUX BONDING TECHNOLOGY

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Clay is the usual raw material for building bricks, tiles and Pavements. As clay decreases in resources and good quality clays do not become available easily and cheaper, new processes and products are looked for.

The new product should have good similarity with the old product.

Fly ash is the silica rich powder available in large quantities and is a problem disposal material. There are many methods developed and being practiced using fly ash. Fly ash also varies slightly in quality.

Fly ash is highly non plastic, and hence moulding becomes very difficult

Fly ash also requires high temperature for firing to bricks

There are many methods available as technology for fly ash utilisation in building components.

Fly ash (<25%) can be an additive to clay for moulding bricks/tiles and other products. The process involves firing.

Fly ash can be mixed with cement and also in cement clinker to produce good quality cements and also the mixtures can be used to mould bricks.

Fly ash-gypsum-lime combinations known as Fal-G process is able to incorporate up to 70% and needs only low temperature, but long curing under water.

Ceramically bonded novel process for high volume fly ash (>80%)

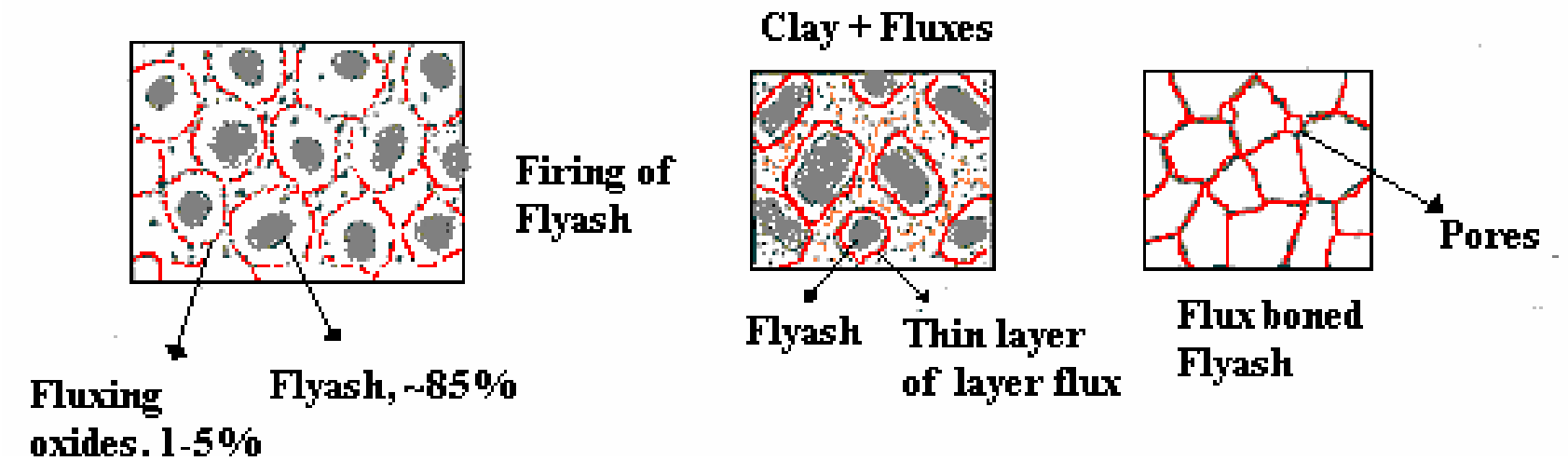
A Novel Process for High Volume Fly Ash Utilisation in Building Components

- High volume utilization (>80wt%)
- Low clay usage for building components (<10%)
- Process similar to clay processing
- Products identical to terra cotta
- Properties comparable or better than terra cotta
- Adaptable to any location near to fly ash source
- Easily adaptable to brick and tile industry
- Cost effective compared to terra cotta

Principle of the Process of Flux Bonding of Fly Ash

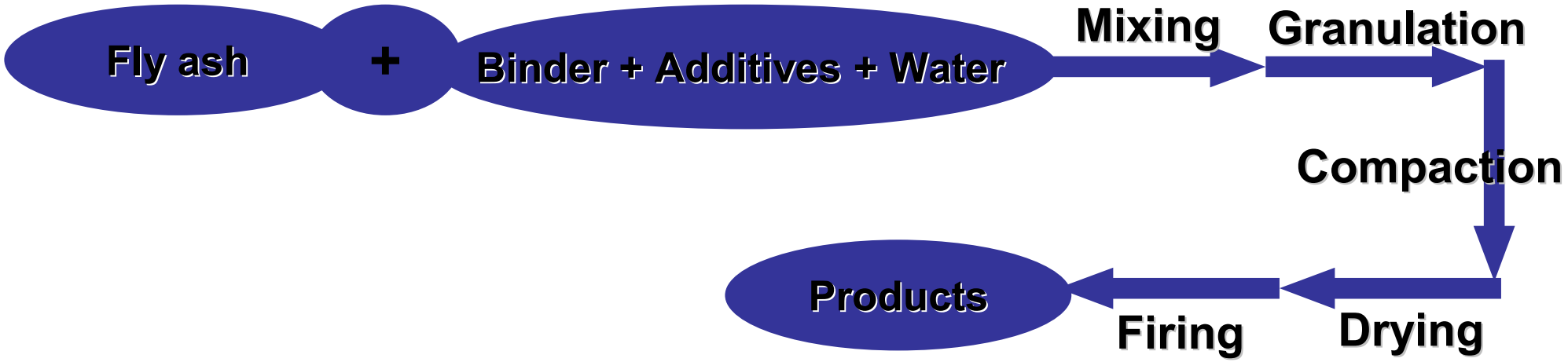
The flux bonding technique is based on addition of certain ceramic glass formers to fly ash which will form liquid phase in the range 800-1000°C, bind the fly ash particles and provide strength, brick-red colour and the desired properties. By controlling the liquid phase and reactivity at the fly ash surface, a range of properties including porous to dense microstructures can be produced making the process generic in nature.

Flux Bonded Fly Ash Process



The Mechanism

The Process Chart



Properties of the flux bonded fly ash made in the pilot plant

PROPERTY	TEST RESULTS	BURNT CLAY BRICKS
Colour	Brick red	Brick red
Water Absorption (%)	15-18	15-20
Density Kg/m^3	1525	1895
Cold Crushing strength (CCS) Kg/cm^2	100-180	80-120
Alternate wet/dry test (durability)- (25 cycles)- % Reduction in strength	< 3%	Not done

Fired fly ash bricks (Thinner)

Glazed fly ash designer tiles

Glazed fly ash products

Glazed fly ash hexagonal tiles

EXPERIENCE WITH FLY ASH FROM RAMAGUNDAM THERMAL POWER PLANT(NTPC)

Varieties of ash investigated

Bottom Ash

Mixed Ash
Fly Ash from Dry ash system (DAETP)
Fly Ash from Ash pond

Clay collected from brick plant in Karimnagar

Clay from a brick and tile plant from kerala

Sieve size (micron)	Bottom flyash	Mixed flyash	Flyash from DAETP	Pond flyash
+30 (>500)	32.9575	**8.1367**	**0.4329**	**0.4374**
-30+100(<500>150)	40.0691	**59.2596**	**15.4284**	**26.0075**
-100+200(<150>75)	12.6305	**8.9623**	**14.7165**	**9.9447**
-200+300(<75>45)	3.6630	**4.5408**	**6.3218**	**6.6756**
-300(<45)	9.6802	**19.1006**	**63.1003**	**56.9348**

Sample No	Sample name	Loss on Ignition (%)
1	Bottom flyash	1.1396
2	Mixed flyash	0.7865
3	Flyash from DAETP	1.5396
4	Flyash from ash pond	3.6709
5	Brick clay from Karimnagar	12.4745
7	Chembu clay/Kerala	4.3281

Common Composition

Fly ash (four type)	- 70 %
Clay (three type)	- 20 %
Additive	- 5%
Binder	- 5%

Firing at 1000 ° C, 3 ^{0}C /min /3 hours soaking

No	Sample	Density g/cm^3	Water absorption (%)	Crushing strength Kg/cm^2
1	**Bottom flyash + Brick clay I**	1.37	25.48	52.13
2	**Bottom flyash + Brick clay II**	1.31	27.01	35.62
3	**Bottom flyash + Chembu clay**	1.60	14.58	170.25

No	Sample	Density g/cm^3	Water absorption (%)	Crushing strength Kg/cm^2
1	**Mixed flyash + Brick clay I**	1.38	24.03	39.75
2	**Mixed flyash + Brick clay II**	1.36	25.22	40.82
3	**Mixed flyash + Chembu clay**	1.60	15.26	133.08

No	Sample	Density g/cm^3	Water absorption (%)	Crushing strength Kg/cm^2
1	**DAETP flyash + Brick clay I**	1.35	23.91	62.16
2	**DAETP flyash + Brick clay II**	1.41	23.26	97.28
3	**DAETP flyash + Chembu clay**	1.66	13.06	228.35

No	Sample	Density g/cm^3	Water absorption (%)	Crushing strength Kg/cm^2
1	**Pond flyash + Brick clay I**	1.36	24.26	45.34
2	**Pond flyash + Brick clay II**	1.36	24.81	67.05
3	**Pond flyash + Chembu clay**	1.62	13.89	210.33