Tap-Hole Clay Raw Materials

THC Raw Materials

- What are they
- Why they are there
- How are they put together

Taphole Clay Definition

A blast furnace taphole clay is :

- Refractory material
- Plastic
- Unshaped material
- Ready to use.

Function of Tap-Hole Clay

- Plug the tap-hole
- Control the flow of Iron & Slag
- Protect the tap-hole and furnace hearth

Taphole Clay

- Needs to be stable in storage
- Needs to stay soft in the gun
- Needs to fully fill the tap-hole
- Needs to set off hard in a defined time
- Needs to drill easily
- Needs to resist the flow of iron and slag
- Needs to wear at a defined rate

Composition of Typical Taphole Clay

- Refractory Aggregate (ie silica sand,bauxite) ~ 50%
- Silicon Carbide ~ 0 - 20%
- FeSN/Si/Al/other additives ~ 0 - 10%
- Superfine Powder eg Ball Clay ~ 5 - 20%
- Carbon Powder or Pitch ~ 5 - 15%
- Phenolic Resin ~ 0 - 15%
- Other Binder /plasticer (ie oil etc) ~ 0 - 15%

Refractory Aggregate

- Typically less than 3mm grain size
- Provides structure and erosion resistance
- Most common materials are silica for low duty and bauxite for high duty
- Alternate aggregates can be used depending on cost, availability and performance requirements

Silicon Carbide

- Typically added to the fines fraction
- Provides resistance to erosion
- Provides slag resistance
- Can dissolve in iron so level cannot be too high
- Acts as an antioxidant

Reactive Metals Additions

- Silicon and aluminium as anti-oxidants to help keep the carbon in the system
- Aluminium to improve hot strength
- Ferro-silicon nitride to improve hot strength and hot erosion resistance

- Additives are very expensive

Superfine Powders

- Clays to provide plasticity
- Ultrafine aggregates to provide chemical resistance but can reduce plasticity
- High surface area affects the levels and behaviour of liquid binders

Carbon Powder or Pitch

- Prevents slag penetration into the matrix
- Contributes to carbon bond formation
- Contributes to plasticity
- Effects drilling. Higher carbon generally leads to easier drilling but can lead to more erosion
- Pitch has environmental and H&S issues

Binders and Additives

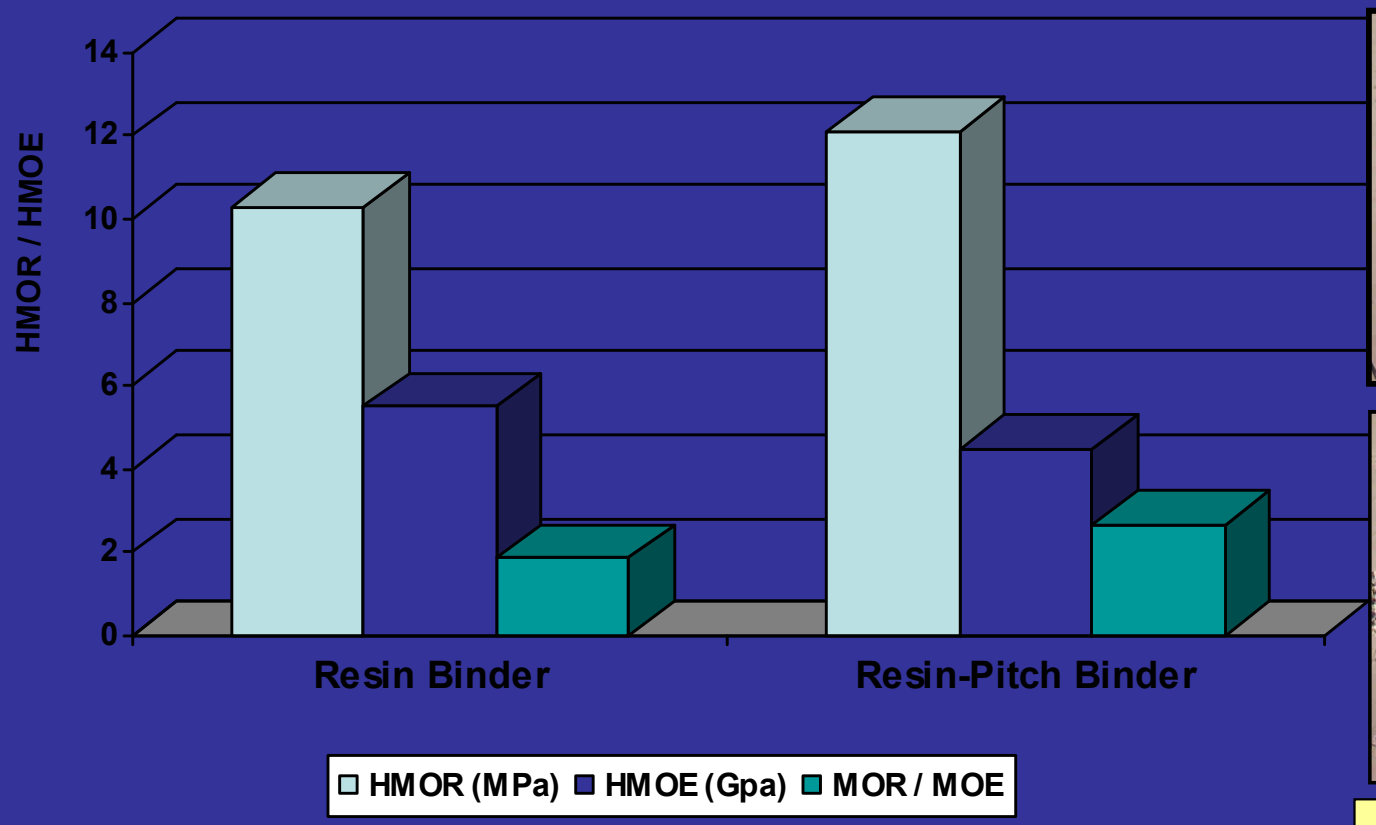
- Resins, pitches and oils can be used
- Provide plasticity
- Effect rate of strength and bond development
- Form bonds at different temperatures
- Contribute to eventual carbon bond
- Pitch has environmental and H&S issues

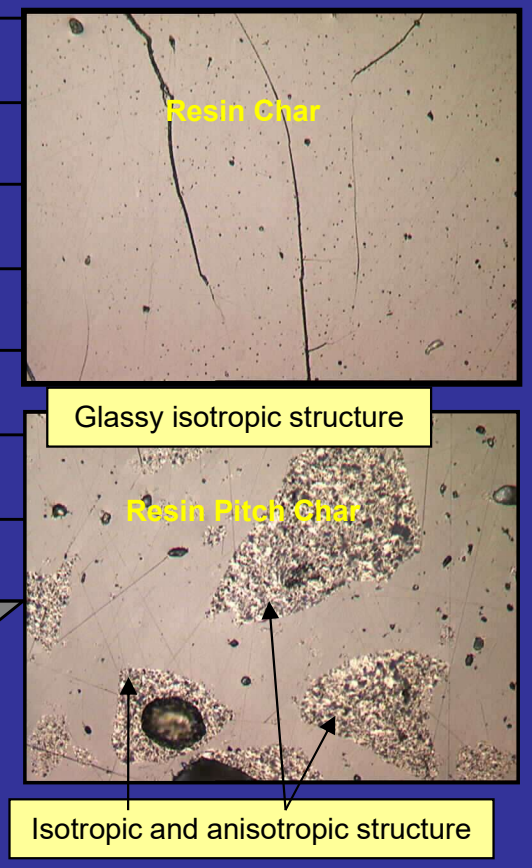
Polycyclic Aromatic Hydrocarbons (PAH)

- Found in tars, pitches, petroleum products

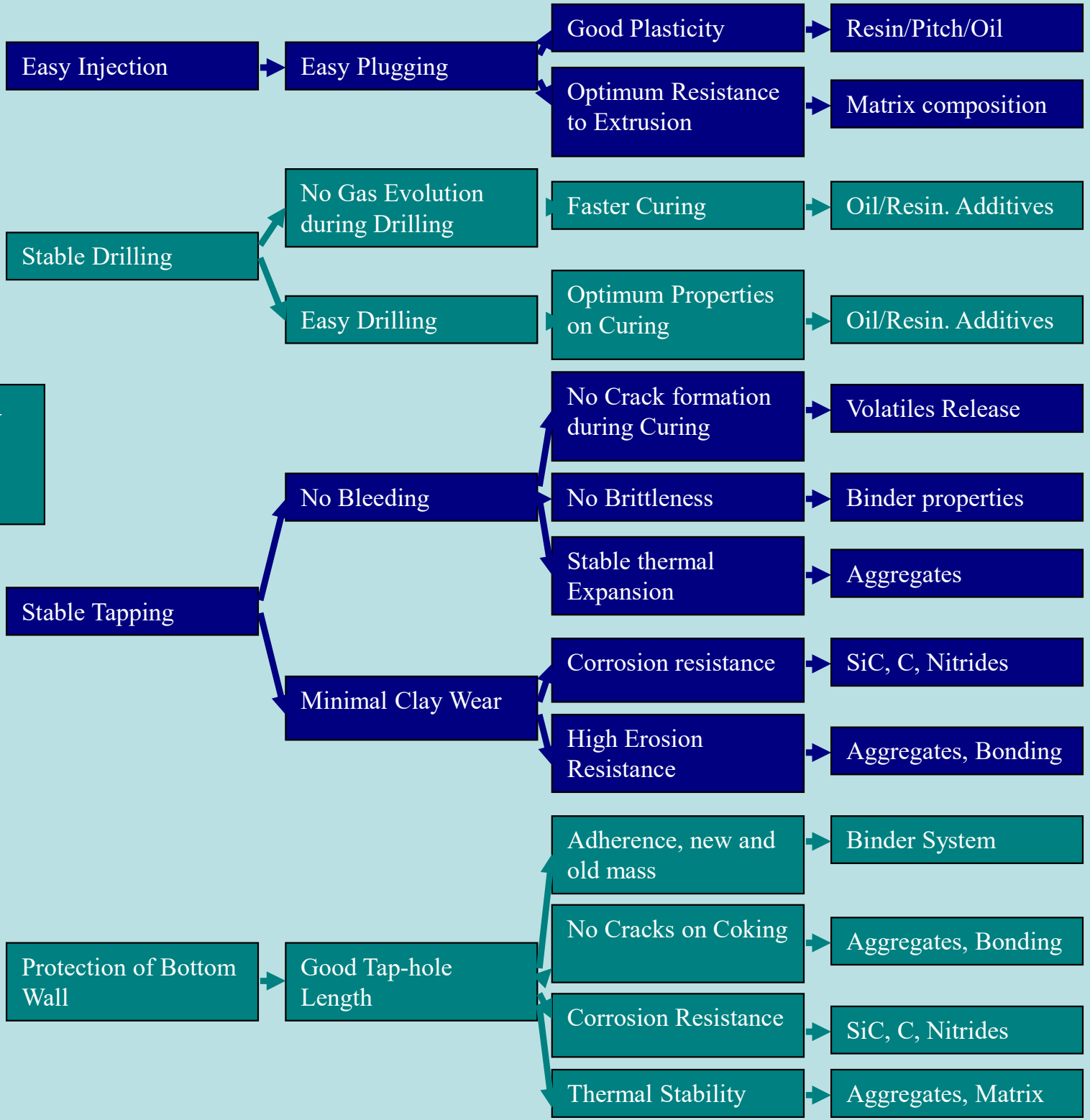
- Over 100 chemicals in the group
- Benzo(a)pyrene identified as main carcinogen. European MSDS marker
- Not all PAH's classified as dangerous substances

Binder Developments





Tap Hole Clay Requirements



Summary

- Tap-hole clays are a complex mixture of refractory materials and organic binders
- The can be designed specifically for an individual blast furnace

- Laboratory characterisation is difficult outside of the actual application.
- Material development depends on good information and feedback

Thank You For Your Attention