



Fluidized Bed type CMC utilizing Coke Oven Exhaust Gas

CMC (Coal Moisture Control)

Nippon Steel & Sumikin Engineering Co.,Ltd.

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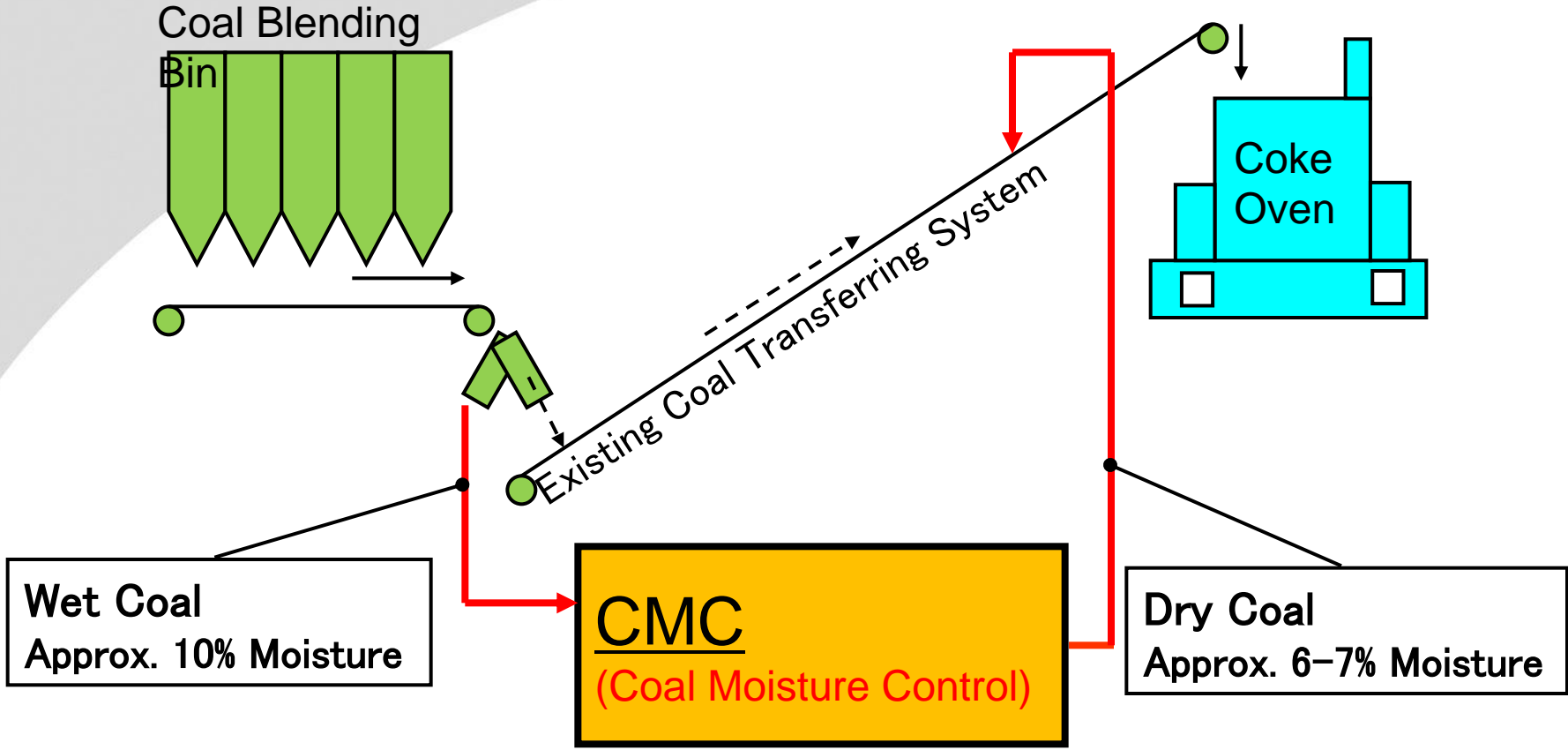
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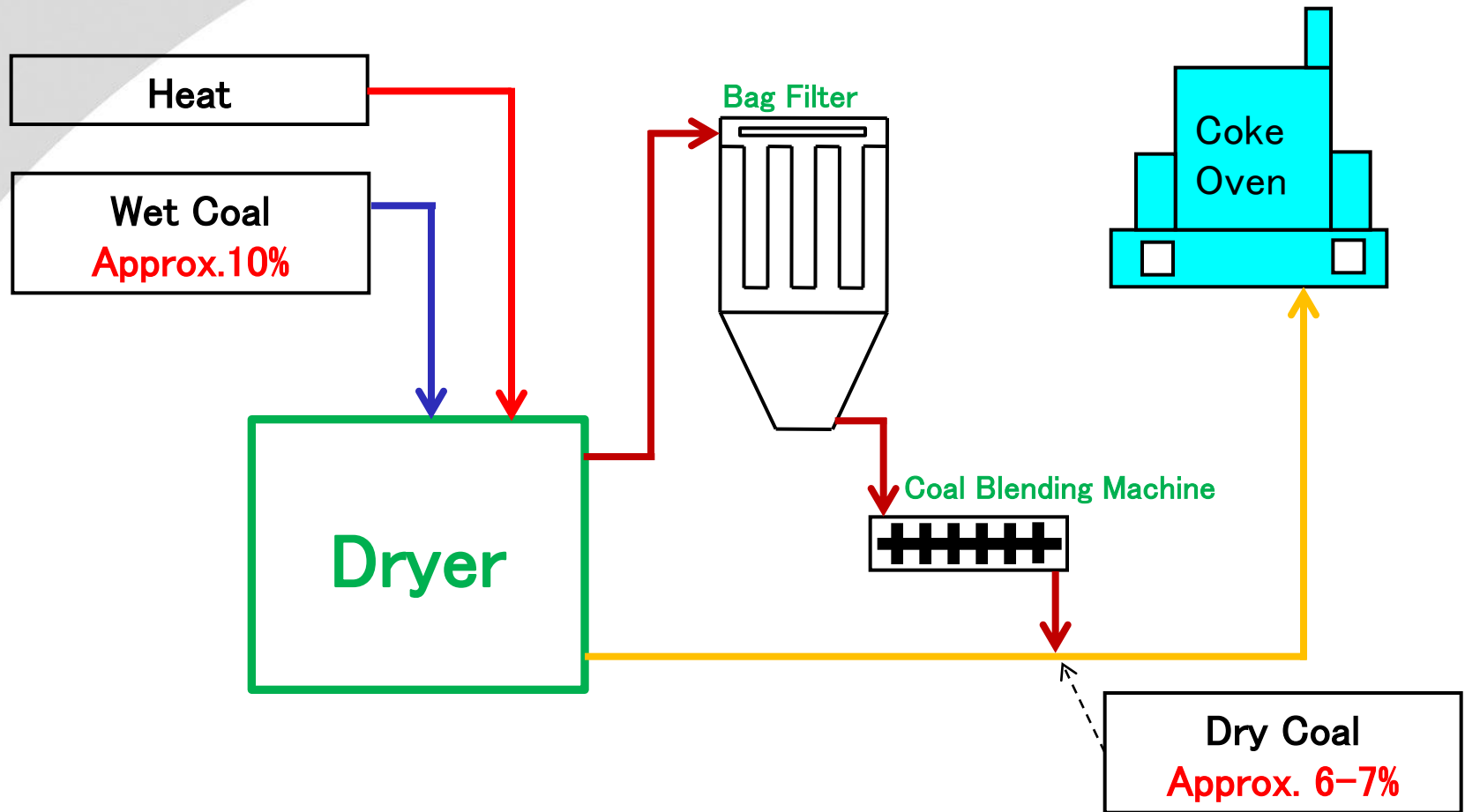
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Outline of CMC



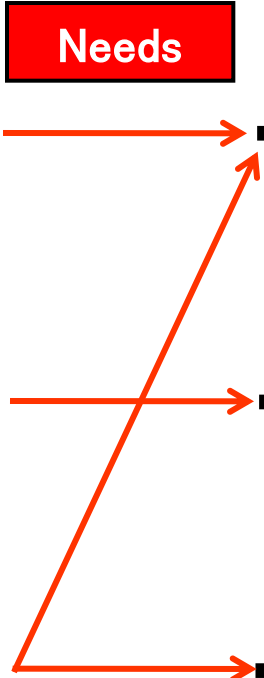
Drying Wet Coal and Reducing Coal Moisture

CMC Process Flow



Global circumstances and Role of CMC

Needs

- Prevention of Global Warming →
 - Expanding Demand for Iron (in Asia) →
 - Expanding Demand for Coal(in Asia) →
- Energy Saving
 - Coke Production Increase
 - Increase the Amount of Low-Quality Coal Usage
- 

CMC can meet those needs.

Merits of CMC

Reference: Merit of Coke Oven Waste Heat-recovery type CMC

(Actual case of coke ovens in Japan when the moisture content is reduced by 4%)

Energy Saving of Coke Oven
(Approx. 340MJ/t-coal)

Coke Quality Improvement
(DI₁₅¹⁵⁰: Approx.1.7%)

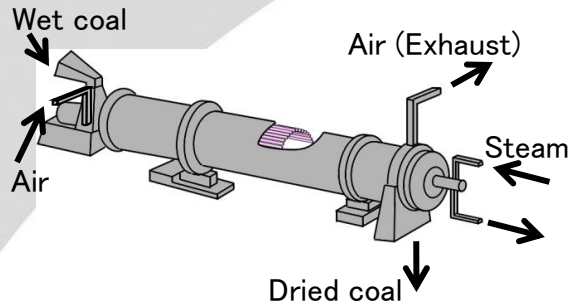
Coke Production Increase
(Approx.11%)

Fifth International Iron and Steel Congress (1986) p312

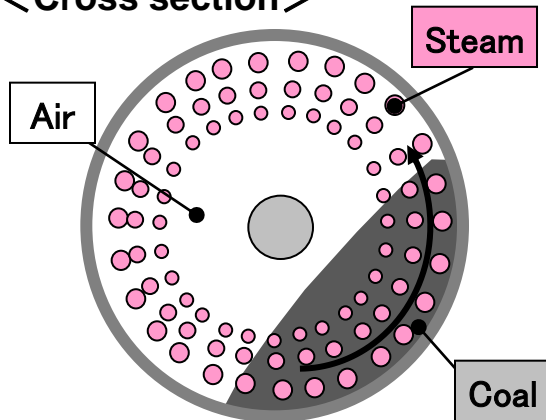
Comparison of Drying Method

**Nippon Steel & Sumikin
Engineering**

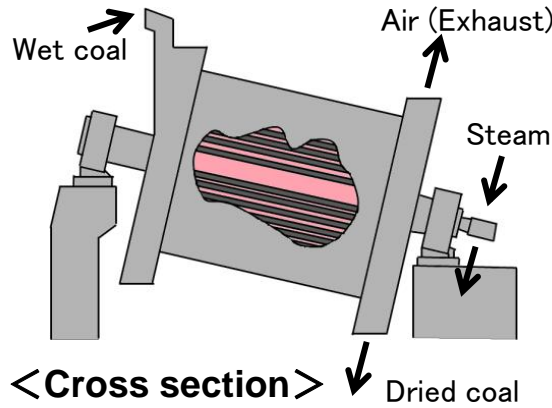
STD (Steam Tube Dryer)



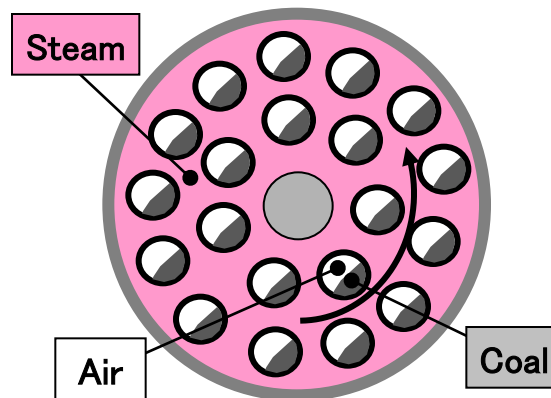
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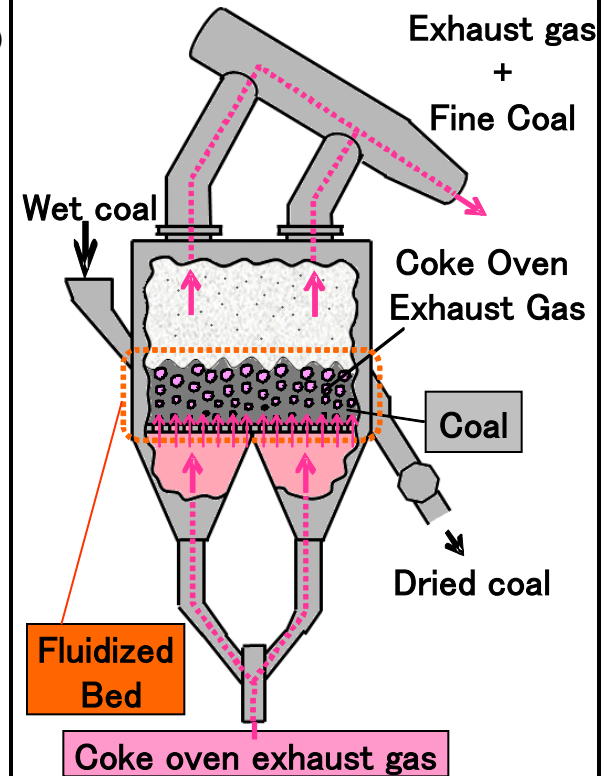
CIT (Coal in Tube)



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FB (Fluidized Bed)

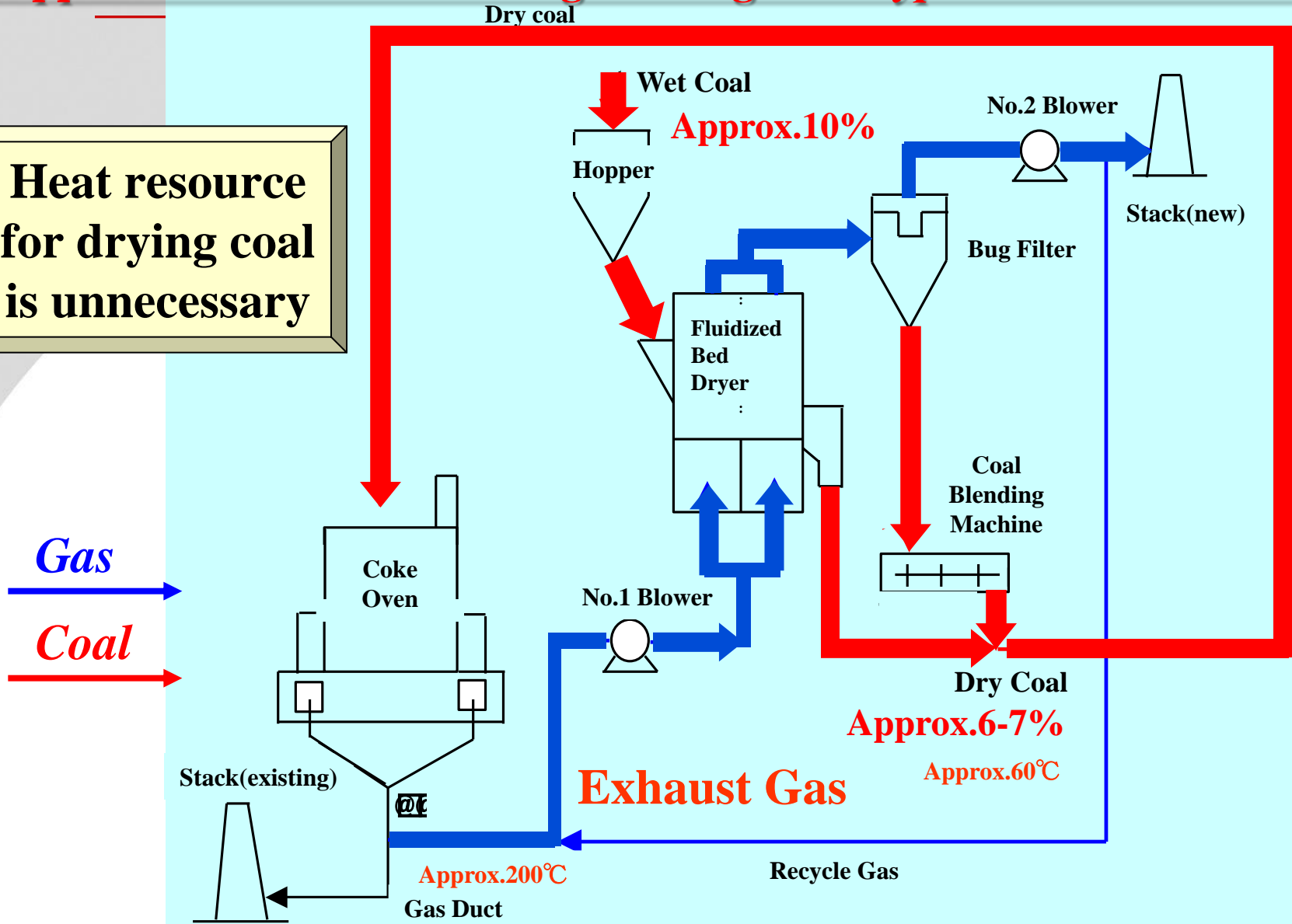


Comparison of Drying Method

Type	STD	CIT	FB
Drying method	<ul style="list-style-type: none"> ▪ Multi-Tube ▪ Steam Inside ▪ Indirect Heat Transfer 	<ul style="list-style-type: none"> ▪ Multi-Tube ▪ Coal Inside ▪ Indirect Heat Transfer 	<ul style="list-style-type: none"> ▪ Fluidized Bed ▪ Direct Heat Transfer
Heat resource	<ul style="list-style-type: none"> ▪ Steam 	<ul style="list-style-type: none"> ▪ Steam 	<ul style="list-style-type: none"> ▪ Coke Oven Exhaust Gas
Energy Cost	<ul style="list-style-type: none"> ▪ Need External Heat Source 	<ul style="list-style-type: none"> ▪ Need External Heat Source 	<div style="border: 1px solid black; background-color: red; color: white; padding: 5px; display: inline-block;">lowest cost</div> <ul style="list-style-type: none"> ▪ Utilizing Waste Heat
Maintenance Cost	<ul style="list-style-type: none"> ▪ A lot of Machine Parts (Rotary Drum ... Fatigue , Wear) 	<ul style="list-style-type: none"> ▪ A lot of Machine Parts (Rotary Drum ... Fatigue , Wear) 	<div style="border: 1px solid black; background-color: red; color: white; padding: 5px; display: inline-block;">lowest cost</div> <ul style="list-style-type: none"> ▪ Box type Structure (Few Machine)

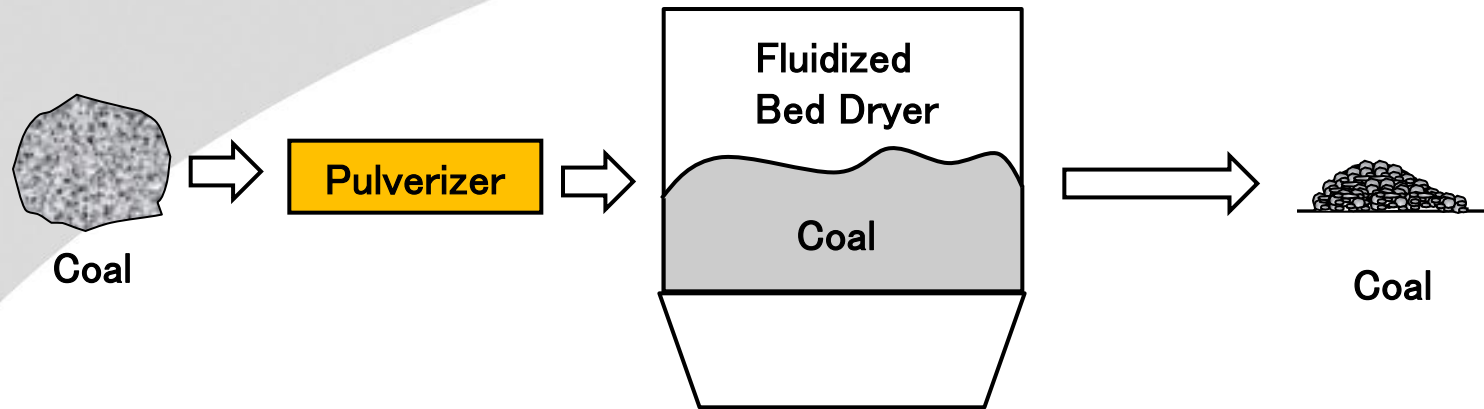
Nippon Steel & Sumikin Engineering's FB type CMC Process Flow

Heat resource for drying coal is unnecessary

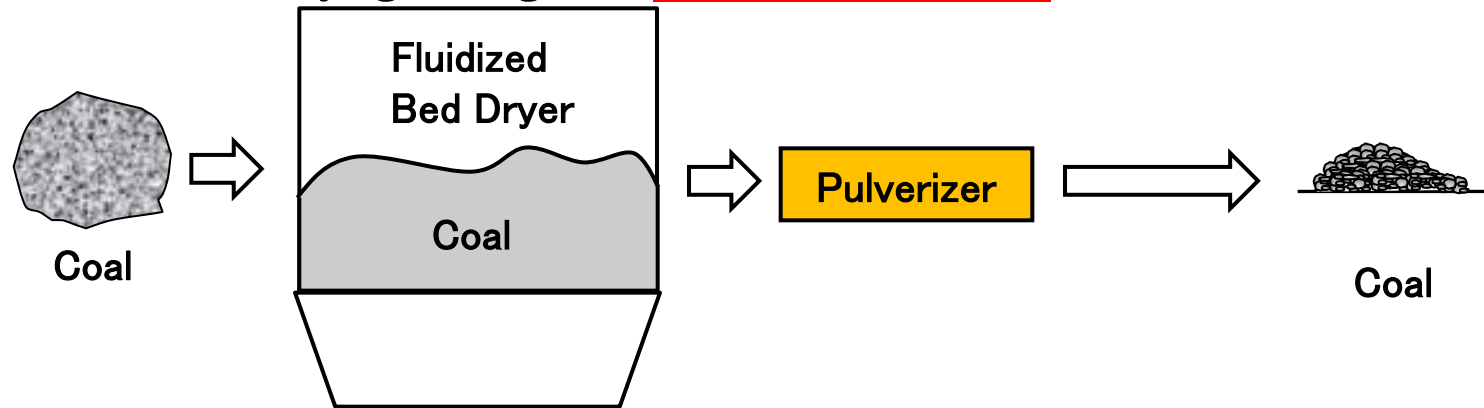


2 Kinds of FB type CMC

- Nippon Steel & Sumikin Engineering's FB ... Drying coking coal after pulverization.



- Chinese FB ... Drying coking coal before pulverization.

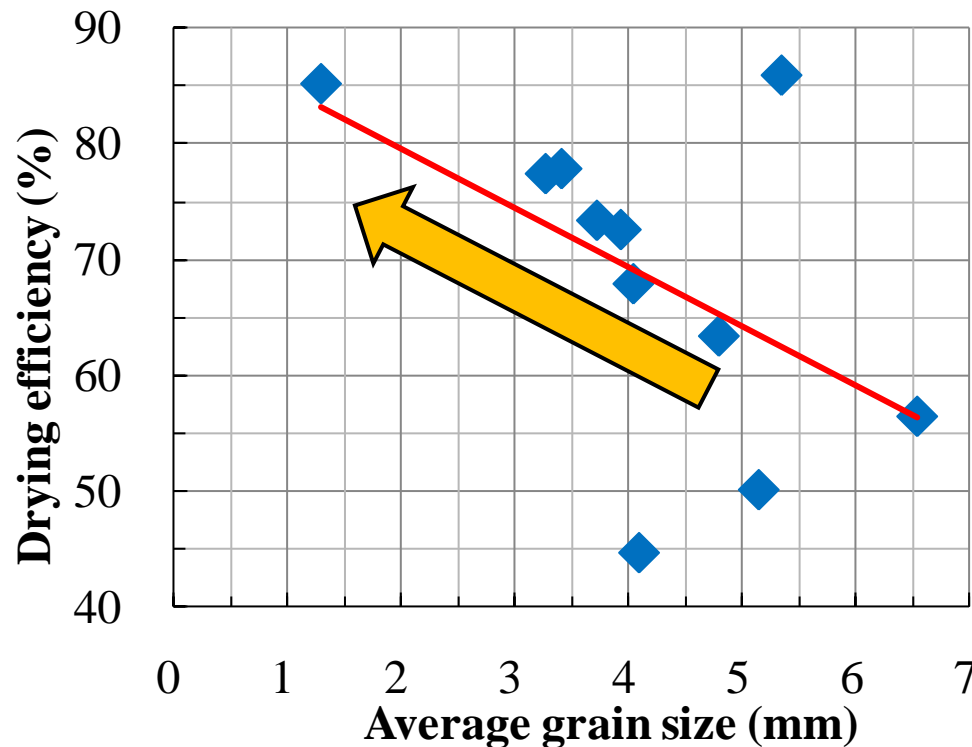


Differences (Depending on Grain size)

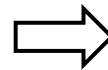
→ ▪ drying efficiency ▪ fluidized condition

Drying Efficiency

Drying Efficiency = (①Evaporative Latent Heat) / (②Heat Value Required for Drying)



Small Grain Size

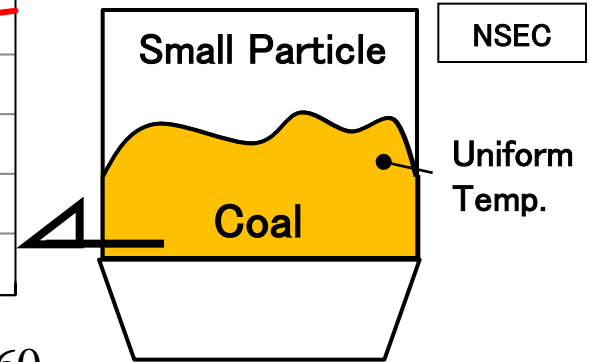
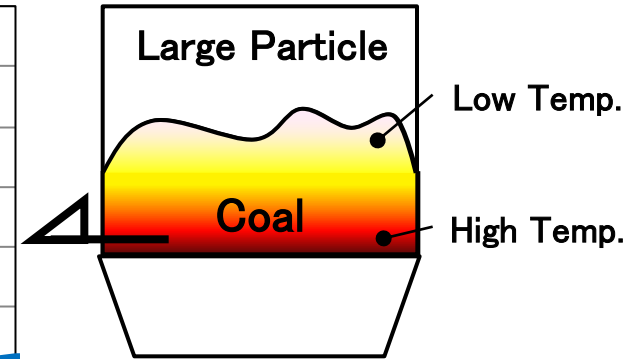
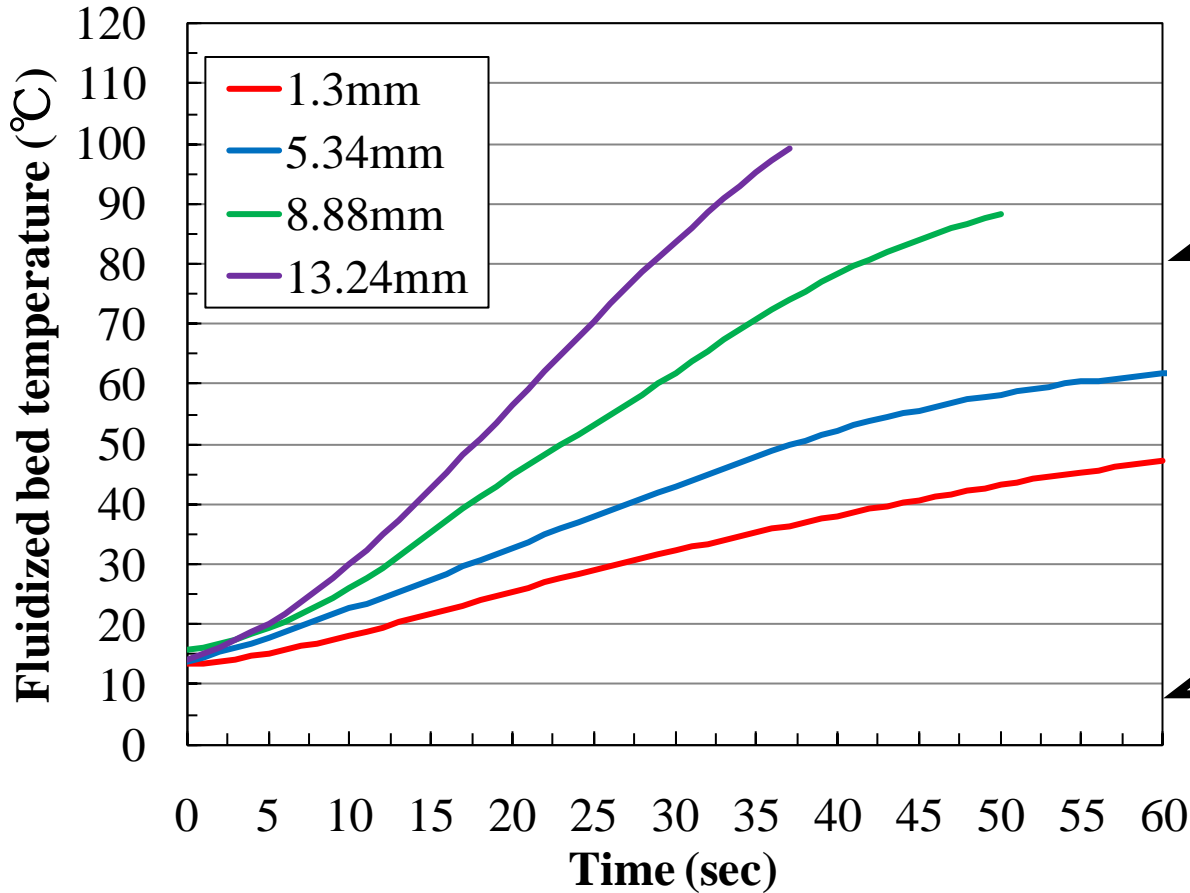


High Drying Efficiency

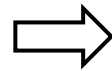
Nippon Steel & Sumikin Engineering's FB is Suitable for CMC !

Fluidized Bed Condition

Different Type



Small Grain Size



Few Partial Overheat or Excess Drying

Nippon Steel & Sumikin Engineering's FB is Suitable for CMC !

Conclusion

- CMC have three merits.

1. Energy Saving of Coke Oven (Approx. 340MJ/t-coal)
2. Coke Quality Improvement (DI_{15}^{150} : Approx. 1.7%)
3. Coke Production Increase (Approx. 11%)

- Energy and maintenance cost is the lowest by drying Nippon Steel & Sumikin Engineering's FB type CMC to compare to STD and CIT.

- Drying coal by FB dryer case,

Small Grain Size  High Drying Efficiency
Few Partial Overheat or Excess Drying

So, drying after pulverization is suitable for FB dryer.

Thank you!

Nippon Steel & Sumikin Engineering Co.Ltd.