

CEMCAP is a Horizon 2020 project with the objective to prepare the grounds for cost- and resource-effective CCS in European cement industry.

# CEMCAP WP9

## Oxyfuel clinker cooler prototype

### Objectives

- Design and operation of an oxyfuel clinker cooler prototype in an industrial environment.
- Investigation of the oxyfuel cooling process concerning:
  - process reliability
  - air and CO<sub>2</sub>-rich gas cooling curves
  - cooling gas sealing aspects
  - operation and safety
- Influence of cooling gas composition on clinker quality (e.g. alite, belite and free lime contents; etc.)



### Findings and conclusions

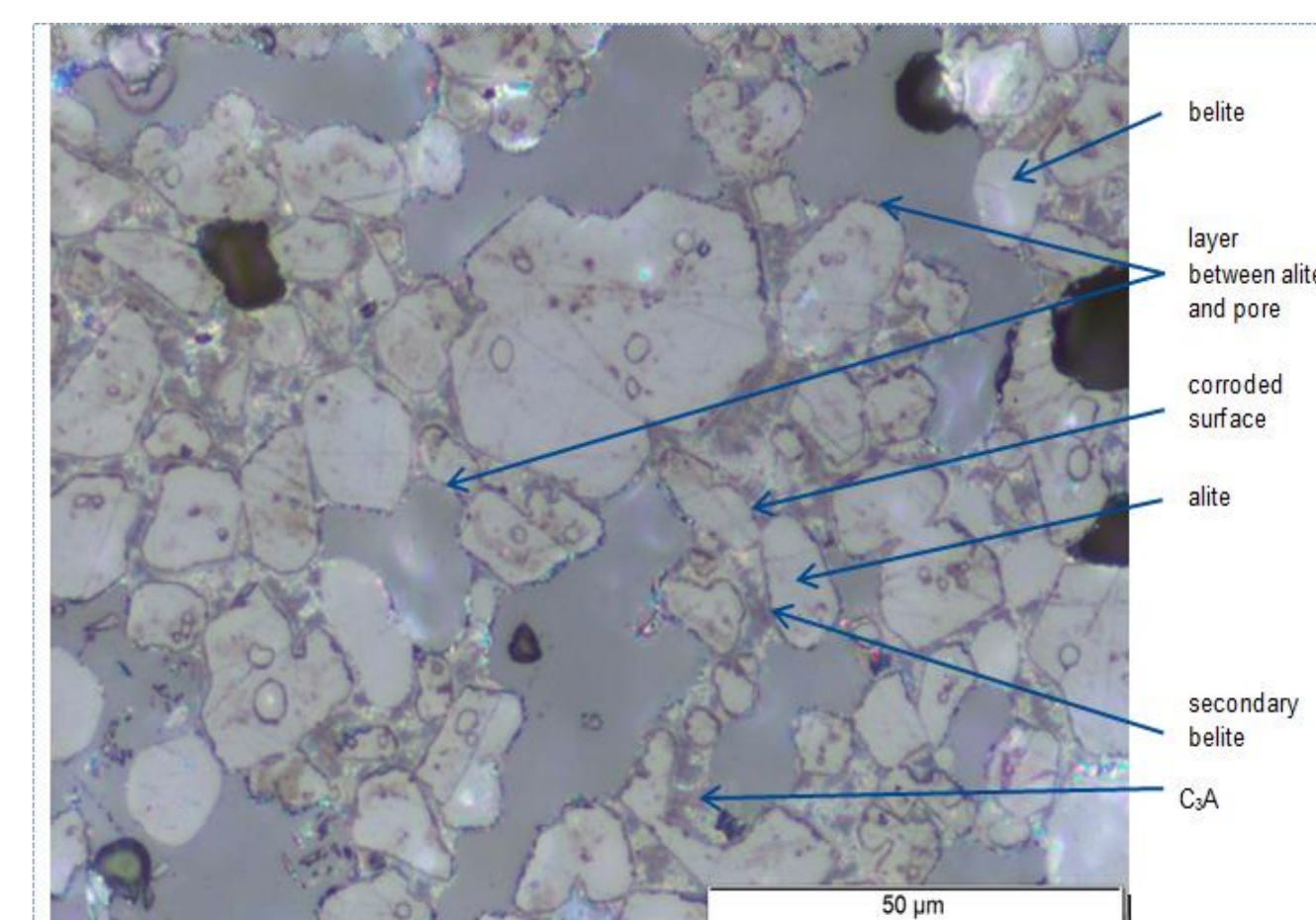
For the design of a future oxyfuel clinker cooler in industrial scale WP9 researchers concluded that...

- ... boundary zones such as the cold clinker discharge system shall get special attention regarding minimisation of false air in-leakage in industrial scale projects.
- ... if high water contents in the cooling medium proves to affect product quality, special attention shall be given to the design of the condenser, whose installation in future oxyfuel cement plants has been envisaged by ECRA.
- ... equipment sealing proved to be effective at pilot scale. The use of similar sealing technology in industrial scale shall be regarded with some caution:
  - operation conditions are more severe in industrial scale
  - sealing's durability and efficiency over time shall be assessed.

### WP9 research

#### Research activities:

- Operation of oxyfuel clinker cooler prototype
- Measurement of relevant process parameters (P; V; T; cooling gas composition)
- Analysis of clinker samples in VDZ's labs:
  - Chemical analysis (XRF)
  - Mineralogical composition (XRD)
  - Microstructure (reflected light microscopy)



#### Experimental results:

- Considerably high false air ingress through cold clinker discharge system outlet.
- No leakages of CO<sub>2</sub>-rich gas occurred during the trials.
- Cooling gas recirculation gave origin to a phenomenon of moisture enrichment.
- The microstructure of the clinker samples indicates fast cooling, which may have its origin in the experimental setup (extraction of finer clinker granules from the kiln and high false air ingress).
- A few clinker samples showed unusual layers of up to 2 μm thickness around alite crystals in contact with pores (probably very fine grained belite and free lime crystals resulting from up to 4% alite decomposition).
- Layer formation cannot be correlated with the high CO<sub>2</sub> concentrations in the cooling medium alone. Thesis: decomposition of alite caused by water in the cooling gas.



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