

LT-Corr

Low-temperature corrosion in biomass fired boilers

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: K1-Centres

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LT-Corr, 04/2015 – 12/2017, multi-firm

New fuels create new challenges

Corrosion on the flue gas side of heat exchangers in biomass fired boilers often occurs at the cold end. It results in decreased life times of affected parts and can cause unplanned plant shut-downs. These low-temperature corrosion problems especially affect economizers and air preheaters as well as the cold end of fired tubes of warm water boilers.

Besides Investigations in real-scale boilers with corrosion problems, BIOENERGY 2020+ performs basic research on the laboratory scale in order to determine the formation of corrosion-causing species.



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Low-temperature corrosion in biomass fired boilers causes damages of economizers and air preheaters as well as fired tubes of warm water boilers. This results in decreased life times of these parts and entails unplanned shutdowns. The increased use of low-quality biomass fuels (low-quality forest wood chips and agricultural fuels) increases the risk for low-temperature corrosion.

For this reason BIOENERGY 2020+ started a COMET-project to determine the causes for the present corrosion damages. Based on the results BIOENERGY 2020+ will develop strategies to avoid corrosion damages in the future.

Within the project affected biomass CHP plants and biomass heating plants are examined on site. By using a newly developed low-temperature online corrosion probe, the exact parameters influencing the occurrence of corrosion are determined. In addition, a comprehensive analysis of fuels, condensates and ash

deposits are carried out to determine the general conditions for the occurrence of corrosion.



Fig. 1: Online corrosion probe after application in biomass heating plant (copyright: BIOENERGY 2020+)

Methodology

Corrosion in biomass fired boilers is generally distinguished between high-temperature corrosion (evaporators and superheaters) and low-temperature corrosion (economizers, air pre-heaters and cold ends of fired tubes).

Low-temperature corrosion usually needs a liquid phase to occur. This liquid typically condenses from the flue gas and subsequently causes corrosion. Condensation occurs, when the temperature of the flue gas falls below the dew point of the corrosion causing substance.

According to literature, the most common cause for low-temperature corrosion is the condensation of acids. These acids can condense at temperatures significantly above the water dew point.

An additional possibility for corrosion results from hygroscopic salts in ash deposits on heat exchanger surfaces. Depending on their hygroscopic properties, these salt particles can form highly concentrated salt solution with the water vapour in the flue gas. Similar to acid condensation, this process is possible at temperatures well above the water dew point.

The investigations in the plants in combination with the lab-scale research shall provide the necessary information to determine, which mechanism prevails under certain boundary conditions and causes the damages in practice.

Besides the determination of corrosion causes different heat exchanger materials will be tested within the project. Scientific partners at Graz University of Technology will analyse all corrosion samples. Their analyses results shall sup-

port the identification of corrosion causes and furthermore allow an appropriate selection of heat exchanger materials.



Fig. 2: Corroded heat exchanger tube
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Impact and effects

Main expected results of the project are:

- Database of dew points of flue gases in biomass furnaces in dependence of the fuel moisture content, the fuel sulfur content, the SO_x content of the flue gas and the oxygen content of the flue gas.
- Identification of low-temperature corrosion mechanisms in biomass furnaces in dependence of the fuels used.
- Providing practical solutions for the material selection of the heat exchangers as well as for the definition of boundary temperatures (flue gas and water) in order to avoid corrosion damages.

Contact and information

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