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# Increased Efficiency during Oxygen Carrier Aided Combustion of Municipal Solid Waste in an Industrial Scaled Circulating Fluidized Bed-Boiler

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**Abstract :** Solid waste volumes are at current predominately deposited on landfill. Furthermore, the impending climate change requires new solutions for a sustainable future energy mix. Currently, solid waste is globally utilized to small extent as fuel during combustion for heat and power production. Due to its variable composition and size, solid waste is considered difficult to combust and requires a technology with high fuel flexibility. One of the commercial technologies used for combustion of such difficult fuels is circulating fluidized beds (CFB). In a CFB boiler, fine particles of a solid material are used as 'bed material', which is accelerated by the incoming combustion air that causes the bed material to fluidize. The chosen bed material has conventionally been silica sand with the main purpose of being a heat carrier, as it transfers heat released by the combustion to the heat-transfer surfaces. However, the release of volatile compounds occurs rapidly in comparison with the lateral mixing in the combustion chamber. To ensure complete combustion a surplus of air is introduced, which decreases the total efficiency of the boiler. In recent years, the concept of partly or entirely replacing the silica sand with an oxygen carrier as bed material has been developed. By introducing an oxygen carrier to the combustion chamber, combustion can be spread out both temporally and spatially in the boiler. Specifically, the oxygen carrier can take up oxygen from the combustion air where it is in abundance and release it to combustible gases where oxygen is in deficit. The concept is referred to as oxygen carrier aided combustion (OCAC) where the natural ore ilmenite (FeTiO3) has been the oxygen carrier used. The authors have validated the oxygen buffering ability of ilmenite during combustion of biomass in Chalmers 12-MWth CFB boiler in previous publications. Furthermore, the concept has been demonstrated on full industrial scale during combustion of municipal solid waste (MSW) in E.ON’s 75 MWth CFB boiler. The experimental campaigns have showed increased mass transfer of oxygen inside the boiler when combustion both biomass and MSW. As a result, a higher degree of burnout is achieved inside the combustion chamber and the plant can be operated at a lower surplus of air. Moreover, the buffer of oxygen provided by the oxygen carrier makes the system less sensitive to disruptions in operation. In conclusion, combusting difficult fuels with OCAC results in higher operation stability and an increase in boiler efficiency.

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