ALTERNATIVE FUELS

(649) - QUALITY ASSESSMENT OF RDF IN THE KILN FIRING OF CEMENT PLANTS

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Cement manufacturers are committed to reduce climate-relevant CO2 emissions and thus are forced to increase the rate of refuse-derived fuels (RDF) in order to improve the resource efficiency of the process and to improve their competitiveness.
A major limitation to an increased use of RDF is the fact that the fuel contains particles which cannot be fully converted along their trajectories and enter the clinker bed where they potentially can cause undesirable effects on clinker quality. Conversion and trajectories (i.e. combustion and flight behavior) are influenced by the technical design and the operating parameters of the kiln as well as the fuel properties. With CFD-simulations and specially developed models, an approximation of the occurring processes can be made. The inhomogeneity of the waste-based fuel is considered by classification of RDF into similar fractions with specific combustion characteristics and particle motion. The effects on clinker quality can be predicted by measurements in rotary kilns and mineralogical analyses. With the joined competences of the project partners, the kiln processes can be simulated in detail to predict the dependencies of fuel properties and impacts to assess the RDF quality.

Initially, fuel samples from several cement plants were analysed by means of sorting, particle size and mass determination as well as thermal analyses to achieve a representative characterization. The RDF investigated, consist primarily of thin plastic foils and of 3-dimensional particles (plastic, paper/ cardboard, textile). The numerical modeling of RDF with CFD provides the contact positions of fuel with wall or clinker bed and the fuel composition at those positions. Laboratory tests were then used to investigate the interactions of the impacted fuel particles with the cement clinker. In addition, the laboratory tests investigated the conversion rates of the RDF particles within the clinker bed and the relaxation of negative effects on clinker quality with increasing residence time. The results were used to define quality criteria for RDF.
By linking laboratory results and CFD-calculations, it is intended to derive recommendations for the optimization of fuel supply systems and to create a generic calculation tool for RDF evaluation. For this purpose, the trajectories of the RDF particles in the kiln are numerically approximated in combination with interpolation of stored CFD-simulation results to account for different operational conditions. For verification of the laboratory results as well as assessment of the accuracy of the CFD-simulations, an operational test in a cement plant was carried out. The results will also be used to show the applicability of the new calculation tool for the estimation of the quality to assess the suitability of a RDF for kiln firing. The calculation tool will be independent of commercial CFD-tools and can be used for process optimization by RDF customization and handling without extensive CFD-simulation.

Palavras-chave : refuse derived fuels (RDF), rotary kiln, fuel evaluation, CFD