Karlsruhe Institute of Technology

Institute for Technical Chemistry, (ITC)
Combustion Technology

KLEAA-Code

Fixed Bed Model for Modelling of Grid Firings

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Background

Against the background of changing legal conditions, due to the Renewable Energy Act, in addition to wood alternative fuels are used in decentralized grate firings with thermal outputs < 20 MW increasingly.
To describe the combustion behavior of these fuels, beside empirical studies numerical models can offer a support.

KLEAA-Code

The KLEAA-Code was developed to simulate the combustion behaviour of fixed bed firings and grid firings using biomass and plastic fuels. The fixed bed is represented by vertically arranged particle layers. This corresponds to a cascade of stirred reactors. Thereby, radial concentration and temperature gradients are neglected, what leads to a one-dimensional description of the reactor events along the fixed bed axis.
The mass transfer only takes place through the gas phase (inside the single layers and along the flow direction);
The blending of particles is not taken into consideration.
The KLEAA-Code contains submodels for drying, pyrolysis, the burnup in the homogeneous gas phase and for the heterogeneous coke burnup. This for example allows the calculation of the combustion of wood chips and substitute fuels based on plastics.
After the validation of the KLEAA-Code for batch processes, the modelling of the combustion processes on a travelling grate and for various fuels is possible.

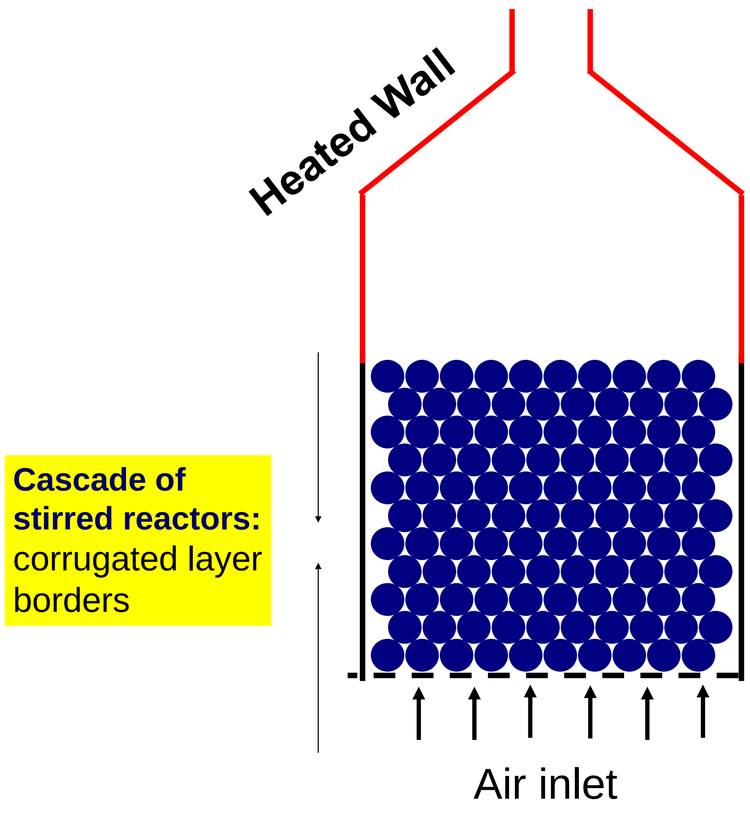

Figure 1: Fixed-Bed Reactor-Model
Source: KIT, H. Mätzing, ITC

Model Assumptions:

- Bulk as a porous layering of spherical particles: Cascade of stirred reactors
- Ignition through the absorption of radiation of the combustion chamber
- energy exchange through heat conduction, convection and radiation
- Mass transfer only through the gas phase
- homogenous gas phase chemistry + heterogeneous reactions
- no radial gradients

For further information go to:
https://www.itc.kit.edu/

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