This paper presents the coupled simulation of steam cycle and firing of the 700 °C boiler. The focus is on the implementation of the coupling algorithm and the modification of the implemented ANSYS FLUENT models to adjust the simulation to the specific boundary conditions of a pulverized coal combustion in a tower-type boiler. Therefore the necessary simulation fundamentals are explained. This includes the used software packages and the combustion modeling in ANSYS FLUENT as well as the coupling algorithm developed. In addition, the required modifications of the ANSYS FLUENT models are described in more detail to provide a realistic boiler simulation. For the validation, the simulation results for the full load case are compared with the thermodynamic design data by the manufacturer ALSTOM Boiler Deutschland. The combustion simulation shows that the porous media model – used for the convective heat exchangers – has to be improved. The main problem is that the model cannot correctly participate in the radiation because the tube surfaces are not represented in the model. So the radiation interaction between combustion chamber and porous media is not correctly modeled. To correct this error, a source term is implemented. Furthermore, the emissivity of the walls is modified to consider the wall shadowing effects in the convective part as well as the radiation between
the convective heat exchangers. The heat radiation in coal-fired boilers is highly complex, so the implemented models can be seen as an approximation. Given this background, the high agreement with the target values of the thermodynamic design can be seen as very positive.

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