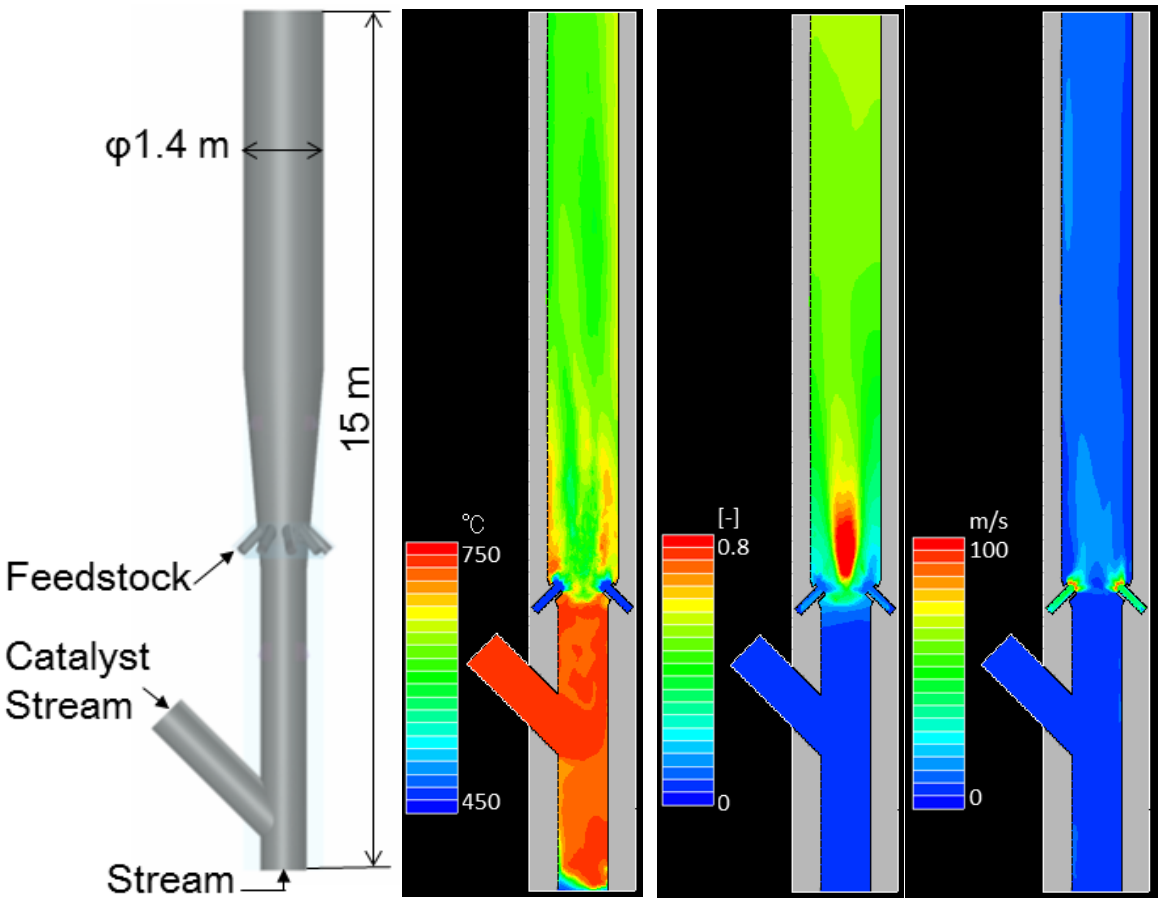
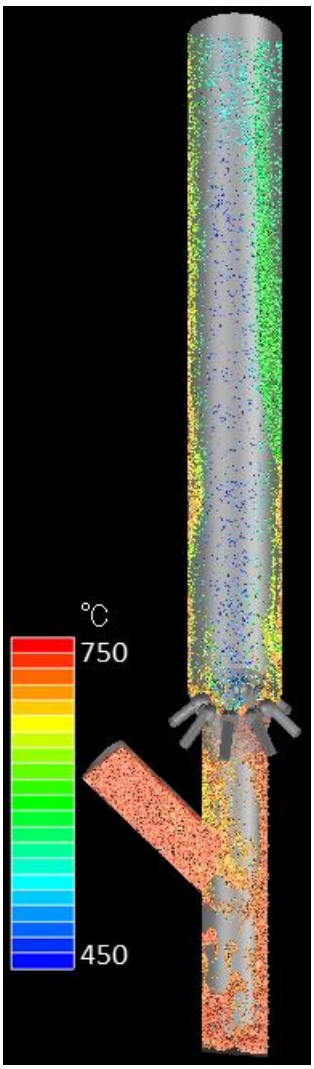
Numerical Simulation of Catalytic Particle Behavior and Droplet Evaporation in FCC Reactor

The compressible gas flow, catalyst particle behavior, and droplet evaporation process in a Fluidized Catalytic Cracking (FCC) reactor are represented by numerical simulation. The heat and radiation fields are also simulated.

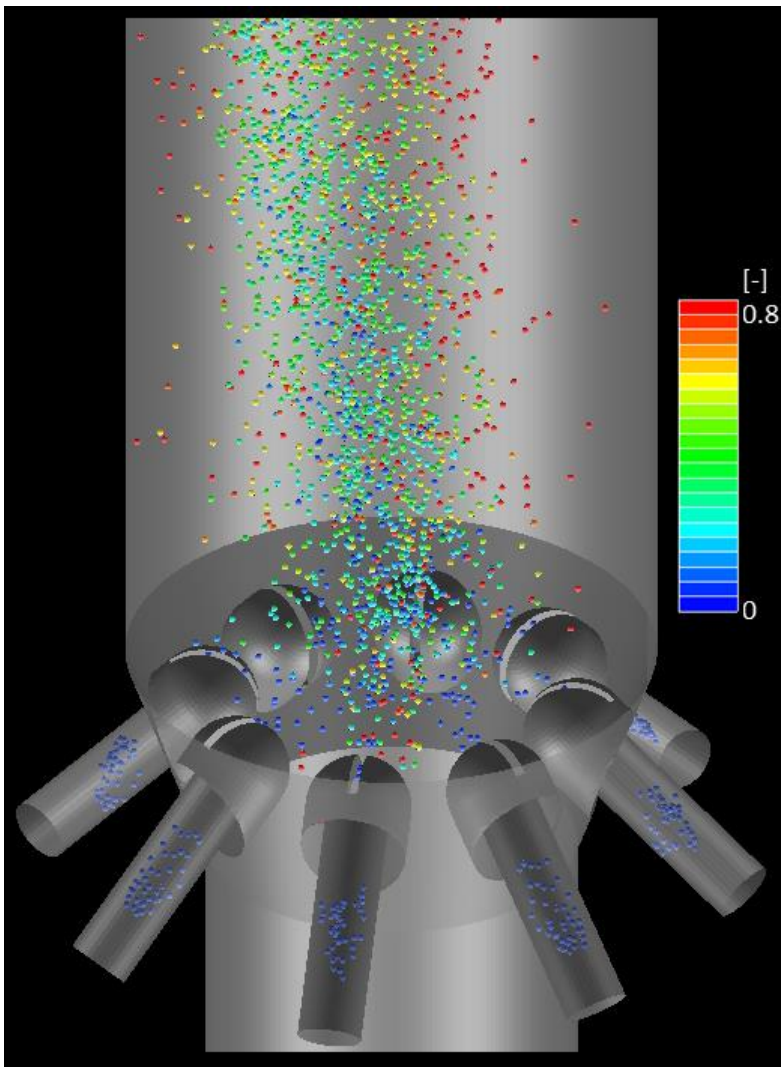


Gas Temperature | Water Vapor Concentration | Absolute Value of Gas Flow Velocity

The DEM-based representative particle model is used to simulate behaviors of catalyst particles and liquid droplets. Both the representative particle diameter (particle diameter used for the calculation of particle contact) and real particle diameter decrease as the particle mass decreases due to evaporation of the liquid. The real particle diameter is used to calculate the catalyst particle and droplet behavior, the radiation field, particle-fluid drag force, particle-fluid heat transfer, particle reaction surface area, and so on. Evaporative gases are produced during the evaporation process.



Catalytic Particle Temperature



Droplet Evaporation Rate

The evaporation rate of the liquid is calculated on the assumption that after the temperature of the droplet particles reaches the boiling point, the amount of heat received by the particles from the hot gas due to particle-fluid heat transfer is converted into vaporization heat.