

Technical field: FCC Riser with high solid flux ($>130 \text{ lbs/ft}^2/\text{s}$):

Questions need to be answered:

1. radial solid concentration
2. vertical pressure drop as a function of gas flow rate and solid flux
3. particle back mixing and gas back mixing which directly determine the residence time for particle and gas
4. particle velocity & granular temperature
5. heat transfer and mass transfer

Current experimental means:

1. pressure taps – for pressure measurement
2. intrusive radial solid concentration measurement – flux probe
3. non-intrusive radial solid concentration measurement – X-ray and γ -ray densitometer; CT
4. solid residence time – radial active particle tracer

Potential experimental means:

1. radial solid concentration – MRI (long term)
2. solid velocity – combination of PIV and laser sheet (mid term)

Current computational model - CFD:

1. turbulence model for gas phase/solid phase
2. empirical model for solid viscosity and solid phase stress
3. Kinetic theory for solid viscosity and solid phase stress using single particle collision/some suggested binary collision model

Potential computational model – combination of CFD and DEM:

1. DEM approach validation: particle – particle contact model (soft or hard) in a gas phase environment (short term)
2. DEM approach validation: particle – fluid interaction (drag law)(short term)
3. validation of kinetic theory using DEM approach (mid term)
4. combination of CFD and DEM (long term)

Final comment: there were many publications regarding the FCC/CFB technology. Most of them were constructed based on lab scale pilot plants at universities and national labs. Those lab experiment settings have limited capacity for handling solid circulation rate. Very few units can provide a solid flux larger than $150 \text{ lbs/ft}^2/\text{s}$. The data obtained from a low solid flux unit may not be sufficient to extrapolate the behavior of a high solid flux unit. Hence, more experimental data of high solid flux units are needed in order to cover a broad range of riser operation.