

MSc Student project

“scaling up the fluidized bed atomic layer deposition (ALD) reactor”

The focus of the work: modeling/simulation and experiment

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The project in summary

Atomic layer deposition (ALD) is an advanced synthesis method with a wide range of applications for atomically precise design and synthesis of different nanomaterials. ALD is originally a vacuum-based process used for flat substrates; however, in the Product and Process Engineering (PPE) group, we have developed an atmospheric pressure ALD process for coating particulate materials, utilizing a fluidized-bed reactor. The products of this process have a wide range of industrial applications, especially catalysts, battery material, LED material, and pharmaceutical applications.

Fluidization is a well-established technology in the chemical industry, enabling intensive interphase contacts, homogenous mixing of gas-solid suspensions, as well as providing excellent mass and heat transfer properties. A fluidized bed reactor, undoubtedly, serves as one of the optimal solid process units for the ALD process. Our current fluidized bed ALD reactors are capable of coating of few grams to few tens of grams of powders, which is suitable for small-scale research purposes. The current project aims to scale up the present lab-scale fluidized-bed ALD, for the first time, to a quasi-pilot unit with a coating capacity of a few kilograms, in both experimental and computational fronts.

What we are looking for:

We are looking for an enthusiastic M.Sc. chemical engineering student interested in nanotechnology, process scale-up, and computational fluid dynamics (CFD) simulation. A background in CFD will help rapid onboarding, and good teamwork is expected.

What is for you in this project:

Working on this topic will enable you to:

- Gain experience of working with fluidized bed reactors
- Gain experimental experience of applying ALD for coating powders
- Work on scaling up a process with commercialization merits
- Improve your simulation and modeling skills, especially CFD skills

For more information, please contact: Dr. Kaiqiao Wu (K.Wu-3@tudelft.nl) or Saeed Saedy (S.Saedy@tudelft.nl)