

M.Sc Thesis Project: Tuning wettability of polymer powder using low temperature atomic layer deposition

Nature of the work: Experimental/Theoretical study

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Motivation and Background

When polymer powder comes in contact with water it tends to agglomerate due to its hydrophilic nature. This limits the applicability of the powder. To improve the wettability an ultra-thin coating can be applied on the powder using atomic layer deposition (ALD) in a fluidized bed (fig1). With this technique a coating can be applied with nano-scale precision. This is done by the sequential introduction of two reactants with a purge step inbetween (fig2). The first reactant reacts in a self-limiting way with the substrate, after purging the first reactant the second one is introduced which also reacts in self-limiting way. This allows for the deposition of exactly 1 molecular layer of coating material per cycle. Because these coatings are ultra-thin, the bulk properties of the powder remain unchanged. ALD is typically done at elevated temperatures, this is however harmful to the polymer powder, meaning that low temperature ALD is required for deposition without destroying the substrate.



Fig 1

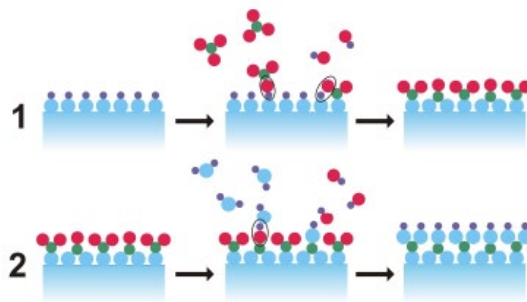


Fig 2

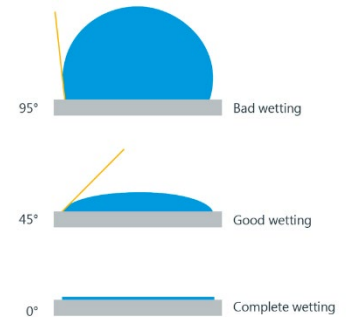


Fig 3

Research project

The goals of this ambitious project is to improve the wettability of polymer powder by applying an ultra-thin coating using ALD. TiO_2 and SiO_2 will be used as coating materials. In order to do this successfully the used pulse and purge times need to be carefully selected, as well as the used temperature (below 60°C). The uniformity of the applied layer of coating and possible damage done to the substrate will be analysed using SEM, TEM, XPS and AFM. The improvement in wettability will be assessed by measuring the water contact angle (fig 3).

Requirement

We are looking for an enthusiastic and initiative CE student with interest in fluidization, polymer, and nanofabrication.

If you are interested, please contact Rens (R.Kamphorst@tudelft.nl) or Albert (A.Santoso@tudelft.nl)