

# Reaction engineering of the carbothermal production of beta'-Sialon

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Centre for  
Technical  
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## Reaction engineering of the carbothermal production of $\beta'$ -sialon

A.M. van Neerven, F. Blömer, R. Metselaar

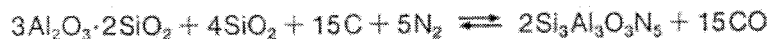


### Introduction

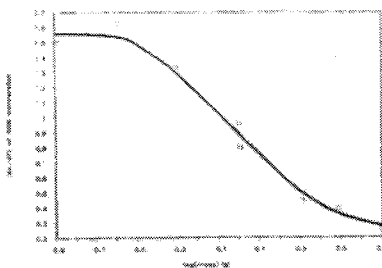
The aim of the investigation is to develop a reaction engineering model for upscaling and reactor design applications.

Szekely's grain model, with spherical pellets and grains in a flat plate geometry, has been selected as the most appropriate.

### Reaction

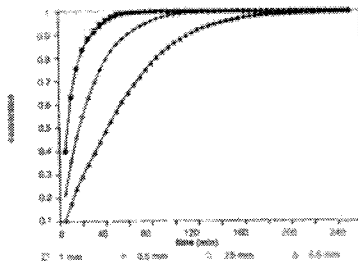


#### Influence of bedlength



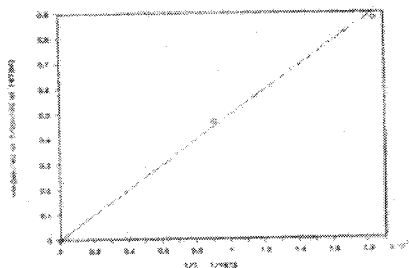
Conversion rate at 50%  
conversion vs reactor mass  
 $T = 1673 \text{ K}$ ,  
 $\text{N}_2$ -flow = 153 ml/min,  
 $D_{\text{tube}} = 25 \text{ mm}$ .

#### Influence of pelletsize



Conversion vs reaction time  
as a function of pellet size  
 $T = 1673 \text{ K}$ ,  
 $\text{N}_2$ -flow = 153 ml/min,  
 $D_{\text{tube}} = 25 \text{ mm}$ .

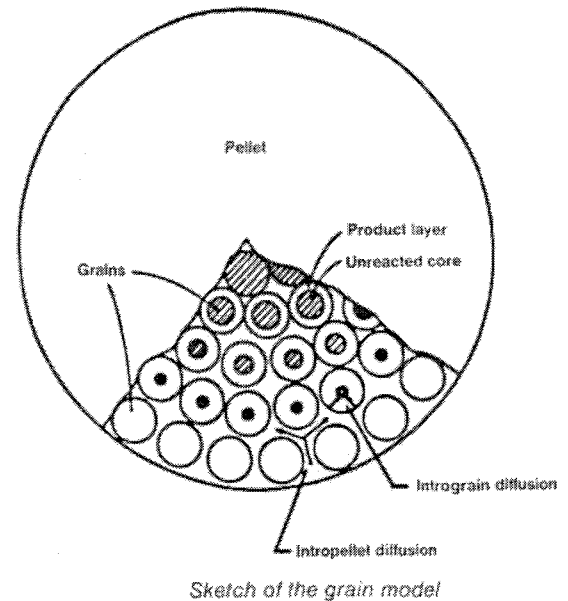
#### Activation energy



$-\ln$  (conversion rate at 50%  
conversion at temperature  
 $T$  / conversion rate at 50%  
conversion at 1673 K) vs  
 $1/T - 1/1673$   
 $\text{N}_2$ -flow = 153 ml/min,  
 $D_{\text{tube}} = 25 \text{ mm}$ .

The grain model is a combination of:

- pore diffusion model for mass transfer in the pellets
- unreacted shrinking core model for the reaction in the grains, where reaction rate is supposed to be linear with the reacting surface area.



### Conclusions

- Reactor is differential when mass content is below 0.25 gram. Below this value CO-concentration does not influence chemical reaction rate.
- Pellet diameter below 1 mm: chemical reaction controls rate.  
Pellet diameter above 1 mm: chemical reaction + pore diffusion control rate  
Non-linear because of grain size distribution
- Chemical reaction activation energy = 405 kJ/mol.