

Reaction engineering of the carbothermal production of beta'-Sialon

Citation for published version (APA):

Neerven, van, A. M., Blömer, F., & Metselaar, R. (1988). Reaction engineering of the carbothermal production of beta'-Sialon. *KGK, Tijdschrift voor Klei, Glas en Keramiek*, 9(10), 279-.

Document status and date:

Published: 01/01/1988

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.



Centre for
Technical
Ceramics

Reaction engineering of the carbothermal production of β' -sialon

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

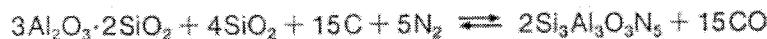


Introduction

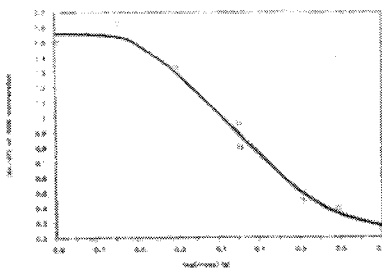
The aim of the investigation is to develop a reaction engineering model for upscaling and reactor design applications.

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

Reaction

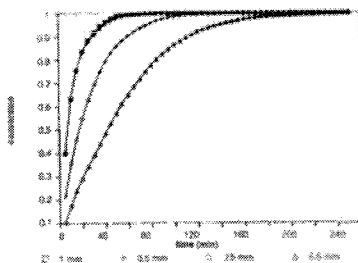


Influence of bedlength



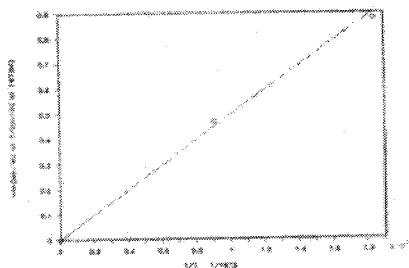
Conversion rate at 50%
conversion vs reactor mass
 $T = 1673 \text{ K}$,
 N_2 -flow = 153 ml/min,
 $D_{\text{tube}} = 25 \text{ mm}$.

Influence of pellets size



Conversion vs reaction time
as a function of pellet size
 $T = 1673 \text{ K}$,
 N_2 -flow = 153 ml/min,
 $D_{\text{tube}} = 25 \text{ mm}$.

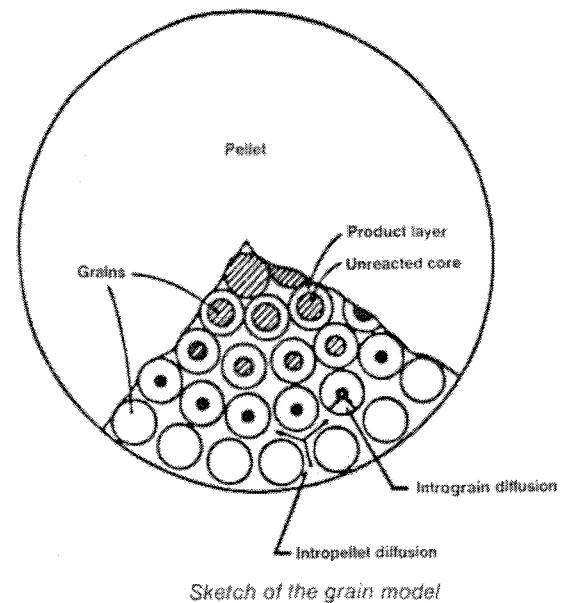
Activation energy



$-\ln$ (conversion rate at 50%
conversion at temperature
 T / conversion rate at 50%
conversion at 1673 K) vs
 $1/T - 1/1673$
 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.