

Letter to the editor : comment on "kinetics of structure development in liquid-liquid dispersions under simple shear flow. theory"

Citation for published version (APA):

Hansen, S. G. (1997). Letter to the editor : comment on "kinetics of structure development in liquid-liquid dispersions under simple shear flow. theory". *Journal of Rheology*, 41(6), 1393-1393.
<https://doi.org/10.1122/1.550848>

DOI:

[10.1122/1.550848](https://doi.org/10.1122/1.550848)

Document status and date:

Published: 01/01/1997

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.

Letter to the Editor: Comment on “Kinetics of structure development in liquid–liquid dispersions under simple shear flow. Theory” [J. Rheol. 40, 1095–1113 (1996)]

[S0148-6055(97)01106-1]

Recently, Patlazhan and Lindt (1996) developed a model to analyze the kinetics of dispersion. Their model is a good quantitative approach to a complex problem. It is unfortunate, however, that the authors do not emphasize the importance of conservation of mass in population balances. For instance, a common mistake occurs when normalizing $\nu(K_j)\beta(K_i, K_j)$, the expected number of K_i drops formed by breakage of a K_j drop. Normalizing the breakup kernel, $\beta(K_i, K_j)$, such that

$$\sum_{i=1}^j \beta(K_i, K_j) = 1$$

does not guarantee conservation of mass. The above equation only assures that the number of droplets formed by breaking a single droplet is $\nu(K_j)$. To conserve mass, the breakup kernel should be normalized such that

$$\sum_{i=1}^j \nu(K_j)(K_i/K_j)\beta(K_i, K_j) = 1$$

(note: $K_i \equiv v_i/v_N$, where v_N is the maximum droplet volume).

This requirement, which can be derived from the population balance, physically means that when a droplet of volume v_j breaks, the sum of the volumes of the daughter droplets must equal v_j .

The kernel in Patlazhan and Lindt (1996) does not conserve mass for $\nu(K_j) > 2$, albeit the gain in mass, resulting from this error, is negligible for relatively short processes. The error does, however, increase with time and may become significant for processes longer than those of Patlazhan and Lindt (1996). In correspondence with Patlazhan and Lindt, they appeared to disagree. Nevertheless, the requirement for conservation of mass can be found in the literature [see, for example, Redner (1990)]. And, from the requirement for conservation of mass, it can be shown analytically that Patlazhan's and Lindt's kernel does not conserve mass.

Shawn Hansen
Materials Technology
Department of Mechanical Engineering
Eindhoven University of Technology

References

- Patlazhan, S. A., and J. T. Lindt, “Kinetics of structure development in liquid–liquid dispersions under simple shear flow. Theory,” *J. Rheol.* **40**, 1095–1113 (1996).
Redner, S., “Fragmentation,” in *Statistical Models for the Fracture of Disordered Media*, edited by H. J. Hermann and S. Roux (North-Holland, Amsterdam, 1990), pp. 321–348.