

Agitation and Mixing

Special Case of the mixture of high viscosity fluids

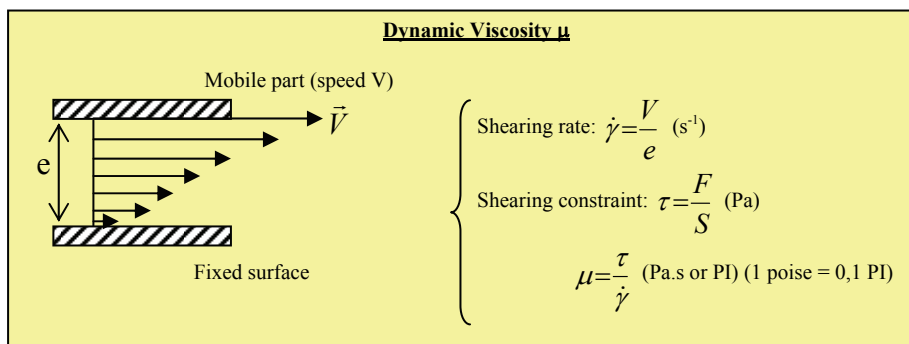
Are of high viscosity, the:

- Food polymers
- Cosmetic and pharmaceutical products

The aim being not to only mix several ingredients, but also to texture the final product (alignment of fibers)
 The mixture of these materials is often done under laminar or transition regimes. There is therefore no transport by vorticity, but only convection due to agitation movements. It is often the case of putting in place the following repetitive cycle:

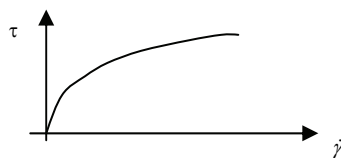
Banding → Shearing → Recombining

The viscosity (μ) of these materials is an indispensable item but sometimes difficult to control.

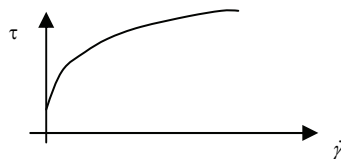


There are 2 types of fluids:

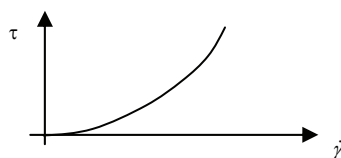
1. The Newtonian fluids ($\mu = C^{te}$)
2. The Non-Newtonian fluids ($\mu \neq C^{te}$), the most frequent
 - a. The rheofluidifying fluids (fruit juices, blood, bread dough ...)
 Viscosity diminishes when the shearing speed increases



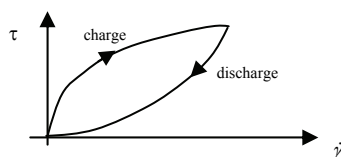
- b. The threshold fluids (paints, varnishes, mayonnaise, white cheese, toothpaste, ...)
 The material does not flow until the constraint attains a minimal threshold



- c. The rheothickening fluids (humidified sand, starch suspension, pizza dough, ...)
 The viscosity increases when the shearing speed increases



- d. The thixotropic fluids (paints, yoghurt, ...)
 The viscosity diminishes under stress with time



e. The viscoelastic fluids

Without constraint, the material tend to take back its initial state

To Learn More:

Literature

- *Agitation et Mélange – Catherine Xuereb, Martine Poux, Joël Bertrand (Editions Dunod)*
- *Mixing : Principles and Applications – S. Nagata (Editions John Wiley)*
- *Publications scientifiques de Philippe Tanguy et Al. (International Journal for Numerical Methods in Engineering, Chemical Engineering & Technology, Chemical Engineering Science, Journal of Non-Newtonian Fluid Mechanics, ...)*
- *Dossier Agitation, Mélange – Michel Roustan, Jean-Claude Pharamond (Techniques de l'Ingénieur)*
- *Dossier Mélange des Produits Pâteux – Guillaume Delaplace, Romuald Guérin (Techniques de l'Ingénieur)*
- *Mélange des milieux pâteux de rhéologie complexe. Théorie - Jean-Louis Chevalier (Techniques de l'Ingénieur)*