Pontifícia Universidade Católica
do Rio de Janeiro

Flávio Henrique Marchesini de Oliveira

Viscoplastic Materials in Engineering Problems

Dissertação de Mestrado

Thesis presented to the Postgraduate Program in Mechanical Engineering of the Departamento de Engenharia Mecânica, PUC–Rio, as partial fulfillment of the requirements for the degree of Mestre em Engenharia Mecânica

Adviser : Prof. Paulo Roberto de Souza Mendes
Co–Adviser: Prof. Mônica Feijó Naccache

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Bibliographic data

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Abstract

Marchesini, Flávio Henrique; de Souza Mendes, Paulo Roberto; Naccache, Mônica Feijó. **Viscoplastic Materials in Engineering Problems**. Rio de Janeiro, 2008. 132p. Dissertação de Mestrado — Departamento de Engenharia Mecânica, Pontifícia Universidade Católica do Rio de Janeiro.

Viscoplastic or yield stress materials are found in a lot of natural processes, and in a wide variety of industries such as food, cosmetic, farmaceutical and petroleum. In these industries, knowing the accurate rheological properties of a viscoplastic material and its behavior in different flows are fundamental for the success of many operations. Nevertheless, the rheometry of this kind of material still presents some challenges, such as yield stress measurements, apparent wall slip, thixotropy and the breakdown of structure on loading the material into the rheometer geometry used. In addition to that, until now some phenomena in different flows involving viscoplastic materials are not well understood, and therefore more investigation is required. This thesis deals with viscoplastic materials, their rheological properties measurements, and their behavior in different kinds of flow. Moreover, a detailed analysis of flows such as viscometric, expansions-contractions, the displacements in capillary tubes, and the displacements inside oil wells was performed.

Keywords

Viscoplastic Materials. Flows. Rheometry. Expansions-contractions. Displacement. Capillary Tubes. Oil Wells.

Resumo

Marchesini, Flávio Henrique; de Souza Mendes, Paulo Roberto; Naccache, Mônica Feijó. **Materiais Viscoplásticos em Problemas de Engenharia**. Rio de Janeiro, 2008. 132p. Dissertação de Mestrado — Departamento de Engenharia Mecânica, Pontifícia Universidade Católica do Rio de Janeiro.

Materiais viscoplásticos, os quais apresentam tensão limite de escoamento, podem ser encontrados em vários processos naturais e em diversas indústrias, tais como: alimentícia, de cosméticos, farmacêutica e do petróleo. Nessas indústrias o conhecimento preciso das propriedades reológicas dos materiais viscoplásticos e do comportamento desses materiais em diferentes escoamentos é fundamental para o sucesso de várias operações. Todavia, a reometria desse tipo de material ainda apresenta alguns desafios como as medidas de tensão limite de escoamento, deslizamento aparente, tixotropia e a quebra da microestrutura na colocação da amostra no reômetro. Além disso, existe o fato de que até hoje alguns fenômenos em diferentes escoamentos envolvendo materiais viscoplásticos ainda permanecem não tão bem compreendidos, o que requer uma investigação mais profunda. Nesse trabalho, uma abordagem dos materiais que apresentam comportamento viscoplástico, dos métodos utilizados para as medições de suas propriedades reológicas e do comportamento desses materiais em diferentes tipos de escoamento é realizada. Além disso, é executada uma análise detalhada de escoamentos, tais como: viscométricos, através de expansões-contrações, envolvendo deslocamentos em tubos capilares e de escoamentos envolvendo deslocamentos em poços de petróleo.

Palavras-chave

Materiais Viscoplásticos. Escoamentos. Reometria. Expansões-contrações. Deslocamento. Tubos Capilares. Poços de Petróleo.

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