Reunião Anual do INCT-FCx - 2022

De 26 a 29/Outubro de 2022,
Hotel Estância Atibainha, Nazaré Paulista/SP

The influence of the length of the alkyl chain of alcohols on the rheological behavior of the lyotropic calamitic nematic phase

Authors: Willian Alves dos Santos, Newller Marcelo Kimura, Anderson Reginaldo Sampaio

Address: Universidade Estadual de Maringá, Departamento de Física.

Abstract: In a lyotropic liquid crystal the basic unities are aggregates of amphiphilic molecules in equilibrium with a solvent. The so-called micelles, they are not composed of a fixed number of molecules and do not have a fixed geometry. The rheological behavior of this system is not simple; it depends on the form of the aggregation and its thermal interaction with the solvent [1]. The external control of the shape of the micellar structure is done using cosurfactant molecules. The most used substances are the aliphatic chain alcohols. The number of carbon atoms present in the alkyl chain of the alcohols modifies the curved part of the micelle, favoring the formation of prolate micelles, a characteristic of calamitic nematic mesophase [2]. This work is focused on the study the rheological response of quaternary Nematic Calamitc (N_c) lyotropic mixtures to the presence of alkyl chains with different sizes. We have made rotational and oscillatory rheological measurements and observed that, differently from what occurs in the thermotropic case, the rheological behavior of the quaternary mixtures presents a non-Newtonian rheological behavior, which is coherent to that observed in a pseudoplastic fluid. We have measured the influence of the shear stress on the resultant effective viscosity, and we have found a strong indications of a minimal orientation tension in this nematic environment. Differently of what occurs in a common pseudoplastic, our mixtures present some hysteresis in the flow curves. We compare this hysteresis with a phenomenon known as thixotropy. Thixotropy is a time-dependent shear thinning property [3]. Considering the type of ordering present in the nematic environment, we associate the hysteresis between the up and down flow curves with the energy per unit volume necessary to modify the intrinsic lyotropic micellar configuration and correlation and, in this context, measure and comment on its characterization parameters.

Key-words: Liquid crystal, lyotropic, rheology, thixotropy.
Support: This work has been supported by the National Council for Scientific and Technological Development (CNPq) – (465259/2014-6), the Coordination for the Improvement of Higher Education Personnel (CAPES), the National Institute of Science and Technology Complex Fluids (INCT-FCx).

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