

ISSN Print: 2664-6781
 ISSN Online: 2664-679X
 IJACR 2025; 7(5): 21-24
www.chemistryjournals.net
 Received: 11-03-2025
 Accepted: 16-04-2025

Ioana Stanciu
 University of Bucharest,
 Faculty of Chemistry,
 Department of Physical
 Chemistry, 4-12 Elisabeta
 Blvd, 030018, Bucharest,
 Romania

Corresponding Author:
Ioana Stanciu
 University of Bucharest,
 Faculty of Chemistry,
 Department of Physical
 Chemistry, 4-12 Elisabeta
 Blvd, 030018, Bucharest,
 Romania

Rheological behavior of DXTIII oil

Ioana Stanciu

DOI: <https://www.doi.org/10.33545/26646781.2025.v7.i5a.275>

Abstract

Programmed Transmission Liquid (ATF) could be a hydraulic liquid that's fundamental for the correct functioning of vehicles prepared with programmed transmissions. As a rule, it is coloured ruddy or green to distinguish it from engine oil and other liquids within the vehicle. In acest articol am determinat patru modele reologice care descriu comportarea uleiului DXTIII obtinute prin fitare exponentiala a datelor experimentale. Uleiul a fost studiat cu rheometer MCR302.

Keywords: Uleiul, Reologie, ULEI comportare, viscozitate

Introduction

Programmed Transmission Liquid (ATF) could be a hydraulic liquid that's fundamental for the correct functioning of vehicles prepared with programmed transmissions. As a rule, it is coloured ruddy or green to distinguish it from engine oil and other liquids within the vehicle. This liquid is outlined to meet the one of a kind requests of an programmed transmission. It is defined to guarantee smooth valve operation, minimize brake band grinding, encourage torque converter work, and give successful equip grease.

ATF is commonly utilized as a pressure driven liquid in certain control controlling frameworks, as a oil in select 4WD exchange cases, and in advanced manual transmissions.

Advanced ATF comprises of a base oil and an added substance bundle that contains a wide assortment of chemical compounds expecting to supply the desired properties of a specific ATF detail. Most ATFs contain a few combination of added substances that progress greasing up qualities, ^[1, 2, 3] such as anti-wear added substances, rust and erosion inhibitors, cleansers, dispersants and surfactants (which secure and clean metal surfaces); dispersantssurfactants kinematic consistency and consistency file improvers and modifiers, seal swell added substances and specialists (which expand the rotational speed run and temperature run of the additives' application); anti-foam added substances and anti-oxidation compounds to restrain oxidation and "boil-off" ^[4] (which expands the life of the additives' application); cold-flow improvers, high-temperature thickeners, gasket conditioners, pour point depressant and petroleum. All ATFs contain contact modifiers, but for those ATFs indicated for a few Passage transmissions and the John Deere J-21A determination, ^[5] the Portage ESP (or ESW)-M2C-33 F detail Sort F ATF (Ford-O-Matic) and Passage ESP (or ESW)-M2C-33 G determination Sort G ATF (1980s Passage Europe and Japan) ^[2] particularly prohibits the expansion of particularly prohibits the expansion of grinding modifiers ^[6]. Concurring to the same oil wholesaler, the M2C-33 G detail requires liquids which give progressed shear resistance and oxidation assurance, superior low-temperature ease, superior EP (extraordinary weight) properties and extra seal tests over and over M2C-33 F quality fluids ^[7].

The grinding modifier implies that the liquid sticks to the surface of the metal marginally more grounded, and so as it were makes a difference to avoid early wear. It would be required for Passage and BorgWarner to demonstrate that their transmissions are some way or another hurt by contact modifiers. In numerous nations, Passage has said that the present day Dex3 liquid fine for the same transmissions that it says require the more seasoned standard ^[8].

There are numerous details for ATF, such as the Common Engines (GM) DEXRON and the Passage MERCON arrangement, and the vehicle producer will recognize the ATF detail fitting for each vehicle. The vehicle's owner's manual will ordinarily list the ATF specification(s) that are prescribed by the manufacturer.

Programmed transmission liquids have numerous performance-enhancing chemicals included to the liquid to meet the requests of each transmission [9]. A few ATF details are open to competing brands, such as the common DEXRON determination, where diverse producers utilize distinctive chemicals to meet the same execution determination. These items are sold beneath permit from the OEM capable for setting up the determination. A few vehicle producers will require "honest to goodness" or Unique Gear Producer (OEM) ATF. Most ATF definitions are open 3rd party authorizing and certification by the vehicle producer.

$$\text{Andrade: } \eta = A \cdot 10^{B/T} \quad (1)$$

$$\text{Bingham: } \sigma = \sigma_o + \eta \dot{\gamma} \quad (2)$$

$$\text{Casson: } \sigma^{1/2} = \sigma_o^{1/2} + \eta^{1/2} \dot{\gamma}^{1/2} \quad (3)$$

$$\text{Ostwald-de Waele: } \sigma = k \dot{\gamma}^n \quad (4)$$

$$\text{And Herschel-Bulkley: } \sigma = \sigma_o + k \eta \dot{\gamma}^n \quad (5)$$

where σ is the shear stretch, σ_o abdicante stretch, η - consistency, $\dot{\gamma}$ - shear rate, n-stream file and k-list of consistency [10-19].

Material and Methods

The consistency of DXTIII oil was measured with the Rheometer MCR302 viscometer within the temperature extend of 20-50°C at shear rate of 10s-1 for 2 minutes. Figure 1 appears the Rheometer.



Fig 1: Anton Paar MCR302

Results and Discussion

Figure 2 speaks to the reliance of energetic consistency on temperature for DXTIII oil. As can be seen within the figure, the energetic thickness of the oil diminishes with expanding temperature.

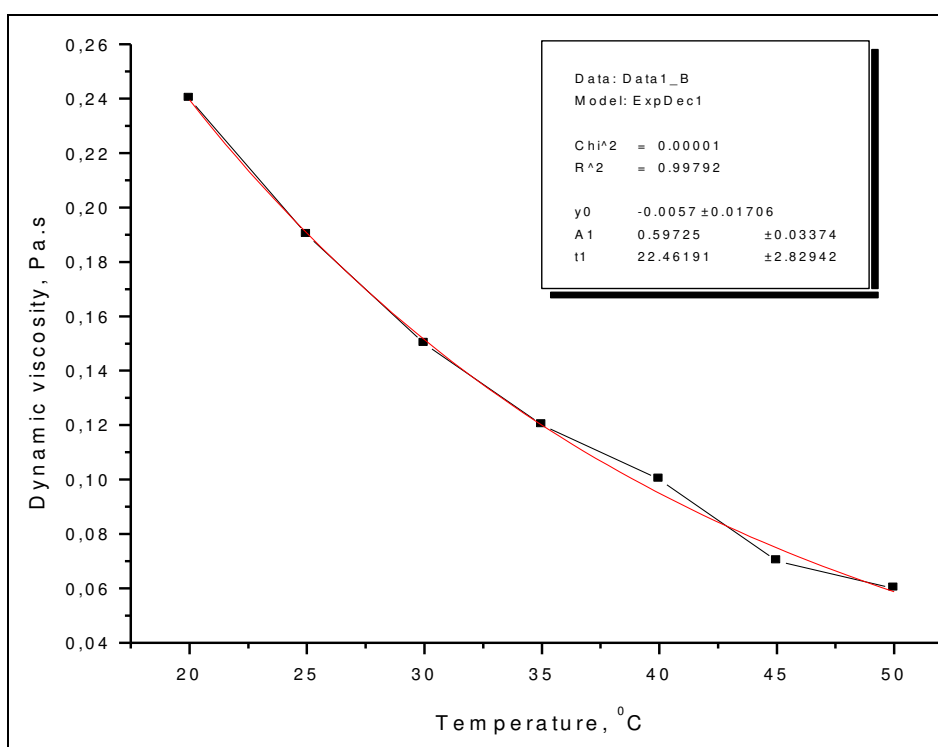


Fig 2: Dependence of dynamic viscosity on temperature for DXTIII oil

Figure 3 appears the reliance of shear push on temperature for the considered oil. The shear push diminishes exponentially with expanding temperature.

Figure 4 speaks to the reliance of energetic consistency on shear rate for the considered oil. The energetic consistency of the oil diminishes exponentially with expanding shear rate.

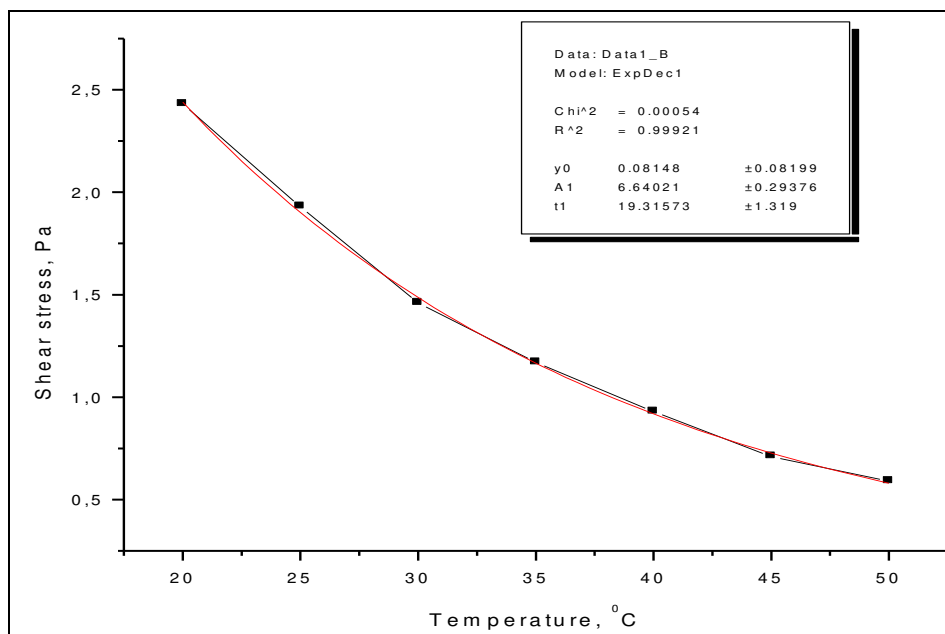


Fig 3: Shear stress temperature dependence for DXTIII oil

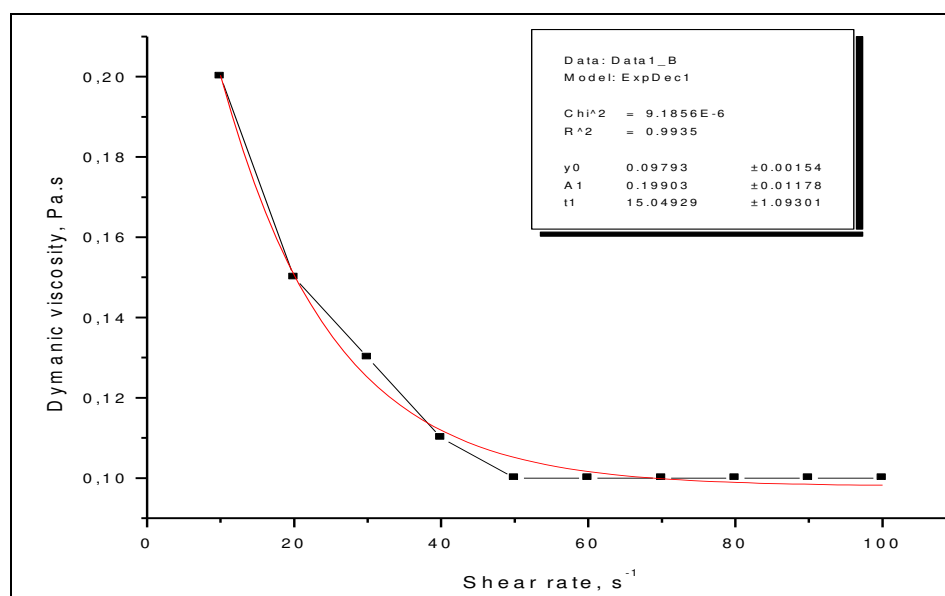


Fig 4: Dependence of dynamic viscosity on shear rate for DXTIII oil

Figure 5 appears the reliance of shear rate on shear push. Shear push diminishes exponentially with expanding shear rate.

In Table 1 we have included the rheological models that depict the behavior of DXTIII oil. For the models found, the relationship coefficients have values near to solidarity.

Table 1: Rheological models for DX-II oil

Models	Parameters model	Correlation Coefficients
$\eta = \eta_0 + A_1 \exp(-t / t_1)$	$\eta_0 = -0.0057$ $A_1 = 0.59725$ $t_1 = 22.46191$	0.99792
$\tau = \tau_0 + A_1 \exp(-t / t_1)$	$\tau_0 = 0.08148$ $A_1 = 6.64021$ $t_1 = 19.31573$	0.99921
$\eta = \eta_0 + A_1 \exp(-\dot{\gamma} / t_1)$	$\eta_0 = 0.09793$ $A_1 = 0.19903$ $t_1 = 15.04929$	0.9935
$\tau = \tau_0 + A_1 \exp(-\dot{\gamma} / t_1)$	$\tau_0 = 0.97341$ $A_1 = 1.85707$ $t_1 = 16.73743$	0.99621

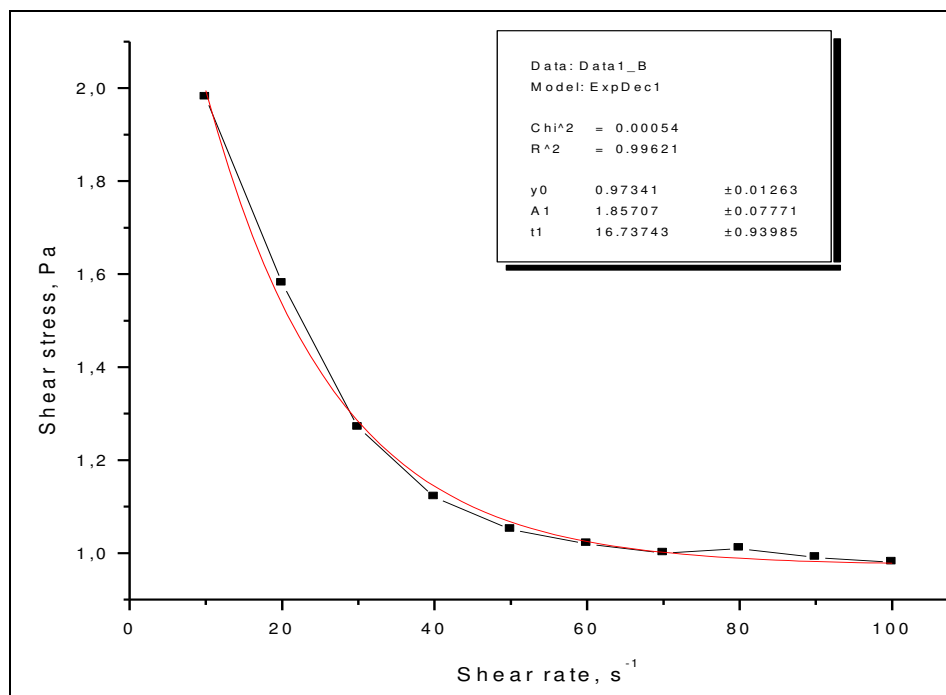


Fig 5: Shear stress dependence on shear rate for DXTIII oil

Conclusions

The rheological models found by exponential fitting of the test information loyally portray the behavior of the oil within the temperature extend at which it was considered. The oil was considered with rheometer MCR302.

Reference

- Vasisht A, Kuchhal P, Anand G. Study of rheological properties of industrial lubricants. In: Conference papers in science. Hindawi Publishing Corporation, 2014, p. 324615.
- Prakash KR, Lathika AS, Ramanna M, Bandadka S, Anand A. Experimental study on tribological, rheological and bio-degradability characteristics of canola oil with TiO₂ nanoparticles as bio-nanolubricants. Tribology in Industry. 2024;46(3):458.
- Vasisht A, Kuchhal P, Anand G. Conference paper study of rheological properties of industrial lubricants.
- Thorat S, Arekar J, Dhokpande S. Re-refining of used lubricating oil and to determine rheological characteristics: A literature review. International Research Journal of Engineering and Technology. 2021;8(4):3567-3572.
- Sharma UC, Sachan S, Sinha S. Analysis of viscosity-temperature behaviour of karanja oil trimethylolpropane ester bio-lubricant base stock. Asian Journal of Chemistry. 2018;30(4):790-794.
- Sharma UC, Sachan S, Trivedi RK. Viscous flow behaviour of karanja oil based bio-lubricant base oil. Journal of Oleo Science. 2018;67(1):105-111.
- Stanciu I. Some methods for determining the viscosity index of hydraulic oil. Indian Journal of Science & Technology. 2023;16(4):254-258.
- Stanciu I. Rheological behavior of corn oil at different viscosity and shear rate. Oriental Journal of Chemistry. 2023;39(2):335-339.
- Stanciu I. Rheological characteristics of corn oil used in biodegradable lubricant. Oriental Journal of Chemistry. 2023;39(3):592-595.
- Stanciu I. Effect of temperature on rheology of corn (*Zea mays*) oil. Oriental Journal of Chemistry. 2023;39(4):1068-1070.
- Afoakwa EO, Paterson A, Fowler M. European Food Research and Technology. 2008;226(6):1259-1268.
- Stanciu I. Rheological behavior of corn oil at different viscosity and shear rate. Oriental Journal of Chemistry. 2021;37(1):247-249.
- Stanciu I. Rheological characteristics of corn oil used in biodegradable lubricant. Oriental Journal of Chemistry. 2021;37(2):440-443.
- Stanciu I. Effect of temperature on rheology of corn (*Zea mays*) oil. Oriental Journal of Chemistry. 2021;37(4):864-867.
- Stanciu I. Journal of Science and Arts. 2019;3(48):703-708.
- Stanciu I. Journal of Science and Arts. 2019;4(49):938-988.
- Stanciu I. Journal of Science and Arts. 2011;1:55-58.
- Stanciu I. [Title not provided]. Journal of Science and Arts. 2018;18(2):453-458.
- Yu W, Wang Z, Lin J, Xiao Y, Zhu L, Huang J, *et al.* Rose-derived porous carbon and in-situ fabrication of cobalt/nickel nanoparticles composites as high-performance electromagnetic wave absorber. Engineered Science. 2024;30(2):1113.