

Thermodynamic Properties of Lubricating Oil

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Abstract

Every liquid has diverse thermodynamic properties at various temperature and weight. We have worked on few thermodynamic properties of greasing oil which must be resolved in every single petrochemical industry. In this research we calculated the error between various methods of estimating the thermodynamic properties.

Keywords - Thermodynamic properties, greasing oil, Dynamic viscosity, Density, Specific gravity, Fire point, Flash point.

I. INTRODUCTION

Thermo dynamic property is a point work. It characterizes the condition of a framework. It is autonomous of the way pursued. Weight, temperature, explicit volume and so forth are thermodynamics property.

There are two sorts

- 1.Intensive property (doesn't rely upon mass of the framework) like weight, temperature.
- 2.Extensive property (rely upon mass of the framework). Like volume, mass, vitality.

Most valuable properties of liquids: -

Properties like weight, volume and temperature which can be estimated straightforwardly. Likewise, thickness, warm conductivity, thickness and so on can be estimated. Properties like inward vitality, enthalpy and so forth which can't be estimated legitimately.

In this venture we will decide the thermodynamic properties like consistency, thickness, explicit gravity, streak point, fire point. The properties like enthalpy and interior vitality cannot be resolved for all intents and purposes.

The thermodynamic properties of liquid fluctuate with temperature and weight.

In this manner, the information acquired by playing out the examinations are gotten at 1 atm and room temperature.

II. METHODOLOGY

A. Experimentation

1. Viscosity

We have utilized the two techniques to decide the viscosity: -

- Orifice viscometer
- Falling ball viscometer

Both the strategies are performed for all intents and purposes and following readings are noted.

B. Formulae

Orifice viscometer: - $\eta_2 = (\eta_1 * \rho_2 * t_2) / \rho_1 * t_1$

Where, η_1 = absolute viscosity of water

t_1 = time of flow of water

ρ_1 = density of water

η_2 = absolute viscosity of greasing oil

t_2 = time of flow of greasing oil

ρ_2 = density of greasing oil

Falling ball viscometer: - $\eta = [2a^2(\rho - \sigma) * g] / 9v$

Where, ρ = density of glass bead

σ = density of viscous liquid

g = gravity

v = terminal velocity

a = radius of glass bead

C. Orifice viscometer

We performed the viscosity experiment on the Ostwald viscometer as well as the falling ball viscometer.

D. Falling ball viscometer

We performed the viscosity experiment on the falling ball viscometer as well and noted the outcomes.

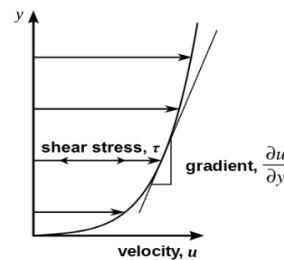


Figure A.1

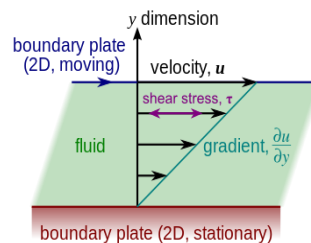


Figure A.2

1. Density & Specific gravity

Numerical equation: - $\rho = m/v$

Where,

- ρ =density
- m =mass of the substance
- v =volume of the substance

$SG = \rho$ of the given substance/ ρ of water
 Were, SG is specific gravity of the fluid.
 $SG = \rho$ of the given substance/ ρ of water

E. Gravity bottle

- The volume of gravity bottle is 25ml, so fill the whole bottle with the greasing oil and insert the cork on to it.
- Substitute the values in the main density expression and then the result we get is the density of the greasing oil sample.

F. Hydrometer

Hydrometer is mostly used in the food industries i.e In the Beer industries and maple syrup industry for measuring the concentration of sugar in the sample.



Hydrometer



Gravity bottle

A. Flash point & Fire point

The fire point is 13-14% higher than the value of the flash point and according to the literature it is near about same. The fire point and flash point of the fluid depends upon the volatility of that fluid.

B. Pensky martin apparatus

Pensky martin open head equipment is used in this research to estimate the flash point as well as fire point of a greasing oil.



Pensky martin apparatus.

III. RESULTS AND DISCUSSION

A. Thermodynamic properties

By the research we derived several outcomes of different thermodynamic properties of greasing oil and the following thermodynamic properties are listed down in the following table.

Table 1

Sr no.	Properties	Method-1	Method-2	Difference
1	Dynamic viscosity	0.082kg/ms	0.0813kg/ms	0.853%
2	Density	880kg/m ³	892kg/m ³	1.345%
3	Specific gravity	0.88	0.892	1.345%
4	Flash point	161°C	-	-
5	Fire point	182°C	-	-

IV. CONCLUSION

The difference between the two values obtained from different methods of viscosity comes out to be 0.853%. The difference between the values of specific gravity and density comes out to be same that is 1.345%. The fire point of the greasing oil is 13-14% higher than the value of flash point.

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