NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

DEPARTMENT OF Metallurgical & Materials Engineering

REPORT

TITLE Pin on disk wear testing study at 40N

Name Deep Narayan

Semester 7th Roll No. 20MM8051

Section – Year IV th (2023)

Signature Deep

Date of Experiment 28/7/2023 Md. Zamruddin

27/08/23

Experiment - Pin-on-disk Testing

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Title: Pin on disk wear testing, study at 40N load

Theory:

Def: In material science, wear is erosion or sideways displacement of material from its 'derivative' & original position on a solid surface performed by the action of another surface

→ Wear is related to interactions between surfaces and more specifically the removal and deformation of material on a surface as a result of mechanical action of opposite surface

→ The need for relative motion between two surfaces and initial mechanical contact between asperities is an important distinction between mechanical wear compared to other processes with similar outcomes

Def: The study of the processes of wear is part of the discipline of tribology

→ The complex nature of wear has delayed its investigations and resulted in isolated studies towards wear mechanisms or processes.

→ Some commonly referred to wear mechanisms (or processes) include:

(a) Adhesive wear
(b) Abrasive wear
(c) Surface Fatigue
(d) Fretting wear
(e) Erosive wear

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Experimental Procedure:

→ Dry sliding wear tests of the specimen are carried out in a pin-on-disk wear testing machine (wear and friction monitor - TR-20LE, DUCOM, Banglore, India)

→ During wear test, the specimen pin is held against an EN 31 steel disk (hardness = 60HRC, HV 695) rotating at 200 rpm under different normal loads (P).

→ The tests are performed in an open air environment

→ The diameter of the circular path traversed by the pin (wear track diameter) is 100mm that accounts for a sliding speed of 1 m/s.

→ Before each test the surface of the pin is polished with silicon carbide emery paper of 800 grit size.

→ Each specimen-pin is subjected to a total test time of 10 min

→ The weight of the pin at the beginning and at the end of each test (after 10 min) is measured in a high precision microbalance (CPA225D, Sartorius, Germany) to find out the weight loss

→ Accordingly overall weight rate is calculated in $g\ m^{-2}\ m^{-1}$

→ During the test, cumulative wear (in μm) and frictional force (in N) data are recorded with time (in min).

→ The coefficient of friction (μ) is calculated from frictional force (F) and normal load (P) using the relationship

$$F = \mu P$$

→ This data is used to generate cumulative wear loss vs. sliding distance and coefficient of friction vs. sliding distance plane plots

$$\text{Sliding distance} = \pi \triangleright N t$$

where $\triangleright$ → track diameter (0.1m)
N → r.p.m.
t → time (30 min)

Observations:

P.T.O. →

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Observations:

Initial weight of sample → 1.805 gm
Final weight of sample → 1.7585 gm

Wear (micro meter)	Frictional Force	Time (sec)	Time (min)	Sliding distance (m)	Coeff of friction
5	11.9	30	0.5	31.4	0.2975
15	12.2	60	1	62.8	0.305
30	14	90	1.5	94.2	0.35
39	11.9	120	2	125.6	0.2975
49	12.8	150	2.5	157	0.32
59	13	180	3	188.4	0.325
68	13.6	210	3.5	219.8	0.34
78	14.2	240	4	251.2	0.355
91	12.9	270	4.5	282.6	0.3875
107	14.2	300	5	314	0.355
118	14.1	330	5.5	345.4	0.3525
135	12.9	360	6	376.8	0.3225
143	14.3	390	6.5	408.2	0.3575
102	12.4	420	7	439.6	0.31
169	13.2	450	7.5	471	0.33
186	17.2	480	8	502.4	0.43
218	21	510	8.5	533.8	0.525
299	25.4	540	9	565.2	0.635
501	25.1	570	9.5	596.6	0.6275
693	24.3	600	10	628	0.6075

Calculations:

$$\text{Wear rate} = \frac{\text{Weight Loss}}{\text{Pin Area} \times \text{Sliding Distance}}$$

$$= \frac{W_1 - W_2}{\pi d^2/4 \times \pi D N t}$$

$$= \frac{1.805 - 1.7585}{\pi \frac{(0.006)^2}{4} \cdot \pi \times 0.1 \times 200 \times 10}$$

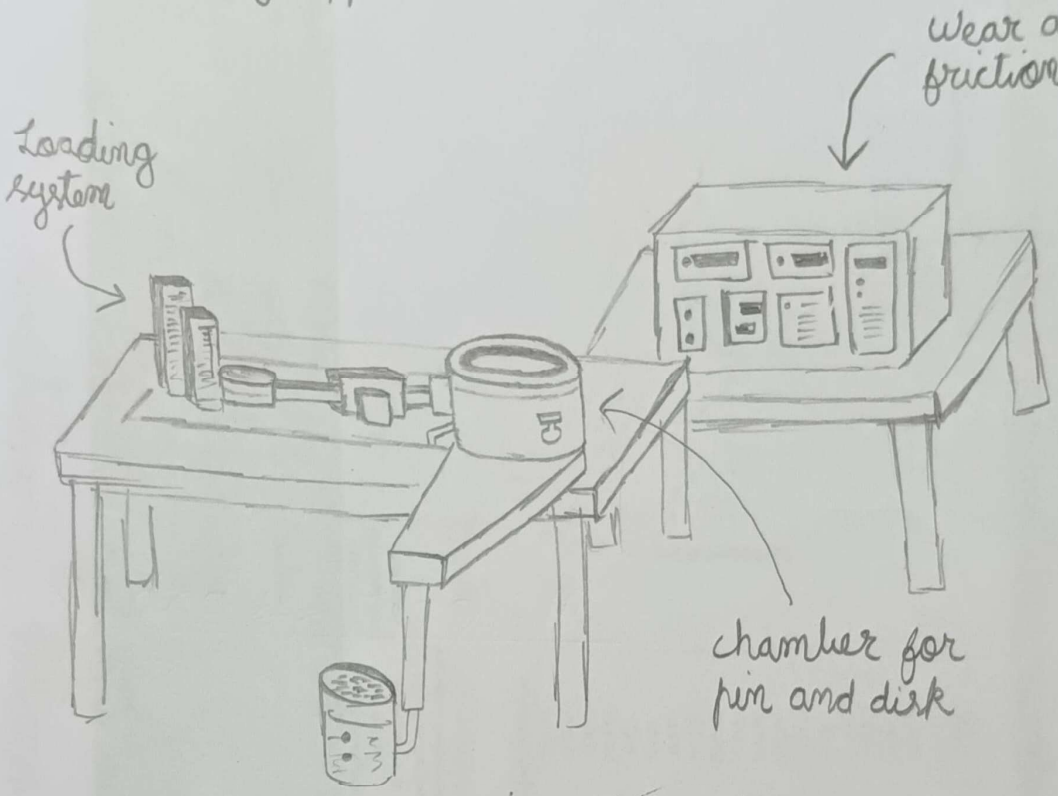
$$= 2.6174 \text{ g m}^{-2} \text{ m}^{-1}$$

Apparatus/Diagram:

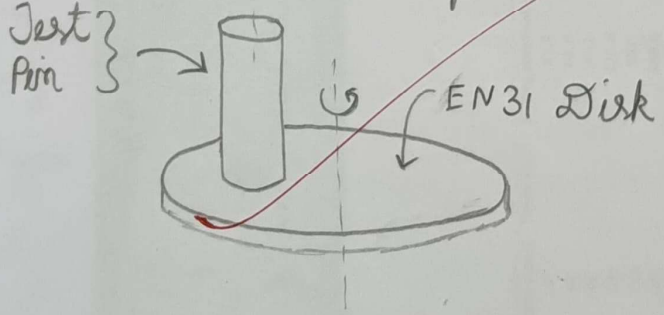
(P.T.O. →)

Apparatus:

Wear testing apparatus



(a) experimental setup



(b) Schematic diagram

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Pin on Disc 28-7.xlsx - Excel

LOAD	40 N
INITIAL WEIGHT	1.805g
FINAL WEIGHT	1.7585g
TRACK DIAMETER	100mm
RPM	200
TIME	10 minutes

EXPERIMENT DATE	28-07-2023
NAME	DEEP NARAYAN
ROLL NUMBER	20MM8051
GROUP NUMBER	3
EXPERIMENT NUMBER	1
SUBMISSION DATE	4/8/2023

Wear(micro meter)	Frictional force	Time(sec.)	Time(min.)	Sliding distance (m)	Coeff. of friction
5	11.9	30	0.5	31.4	0.2975
15	12.2	60	1	62.8	0.305
30	14	90	1.5	94.2	0.35
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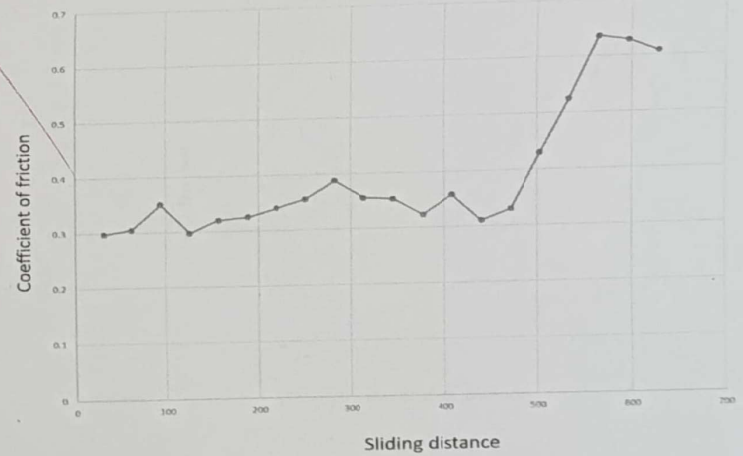

Name : Deep Narayan
Roll No : 20MM8051
Reg No : 20U10719

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FINAL WEIGHT	1.7585g
TRACK DIAMETER	100mm
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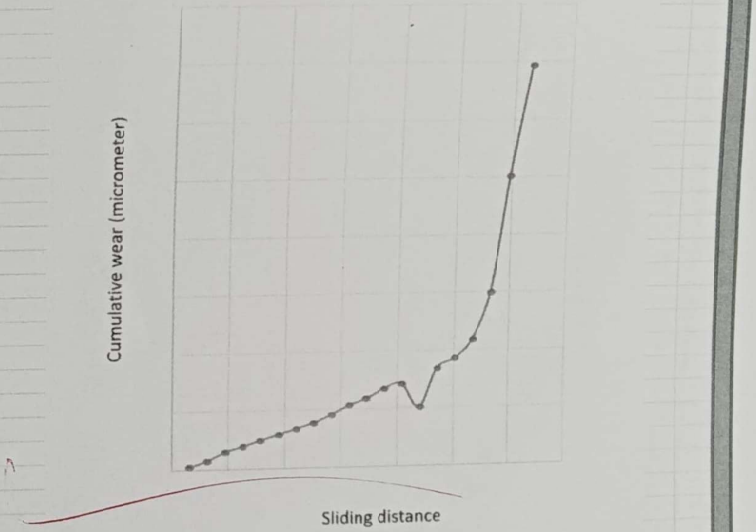

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