

Table 3: Wear rate of a mild steel as a function of load for different lining material

Sl. No.	Lining material	Normal load (N)	Weight loss		Wear rate (N/s) * 10 ⁻⁶
			Time in sec		
			300	600	
1	Rubber	2.583	0.06	0.12	1.962
		5.168	0.12	0.25	4.022
		7.753	0.28	0.54	8.829
		10.337	0.30	0.56	9.120
2	Wood	2.583	0.10	0.21	3.433
		5.168	0.22	0.44	7.194
		7.753	0.23	0.45	7.357
		10.337	0.27	0.53	8.665
3	Grinding wheel	2.583	0.55	1.11	18.148
		5.168	1.19	2.40	39.240
		7.753	1.26	2.56	41.856
		10.337	2.17	4.28	69.978

Wear rate of a selected materials Aluminium, Mild Steel & Cast iron as a function of load for different lining material and Olivine sand having grain size 24 as the abrasive media, are tabulated in table 1, 2& 3. The plot of Wear rate v/s load of aluminium, Cast iron & Mild steel for different lining materials are shown in figures8, 9 & 10 respectively. From the plots it is observed that, grinding wheel produces more wear as compared to wood and rubber for Aluminium, Cast iron & Mild steel, because of the grains in the wheel which assist the wear.

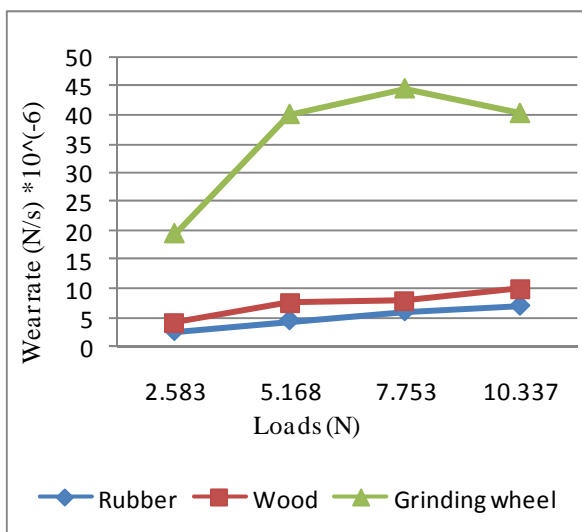


Figure 8: Wear rate v/s load of aluminum for different lining materials

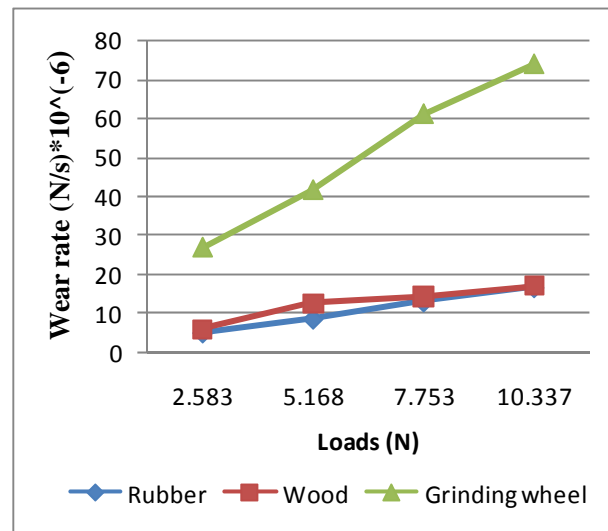


Figure 9: Wear rate v/s load of cast iron for different lining materials

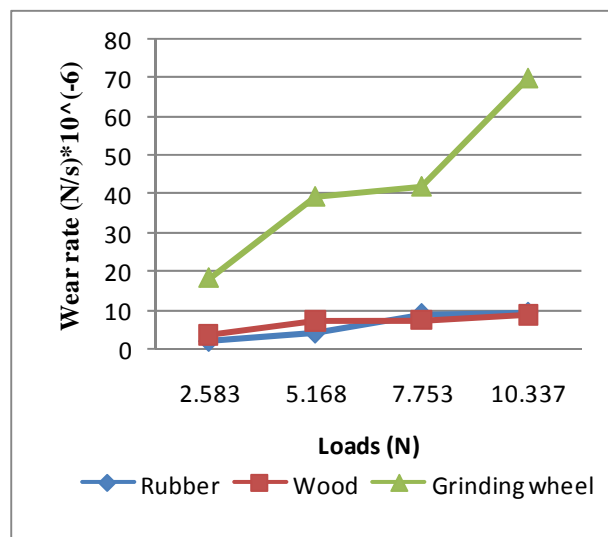


Figure 10: Wear rate v/s load of mild steel for different lining materials

4.3 Temperature as a Function of Time

Temperatures of a selected materials Aluminium, Mild Steel & Cast iron as a function of Time for different lining material at Normal Load of 10.337 N and Olivine sand having grain size of 24 as the abrasive media, are tabulated in table 4, 5& 6 respectively. The plot of Temperature v/s Time of aluminium, Mild Steel & Cast iron for different lining materials are shown in figures 11, 12 & 13 respectively.

Table 4: Temperature of aluminium as a function of time for different lining materials

Sl. No.	Time in seconds	Temperature °C		
		Lining material		
		Neoprene	Teak	Grinding
1	0	30	26	28
2	60	33	30	39
3	120	35	34	56
4	180	36	36	70
5	240	37	38	80
6	300	38	40	85
7	360	39	42	90
8	420	40	44	94
9	480	41	46	98
10	540	42	48	101
11	600	42	50	103

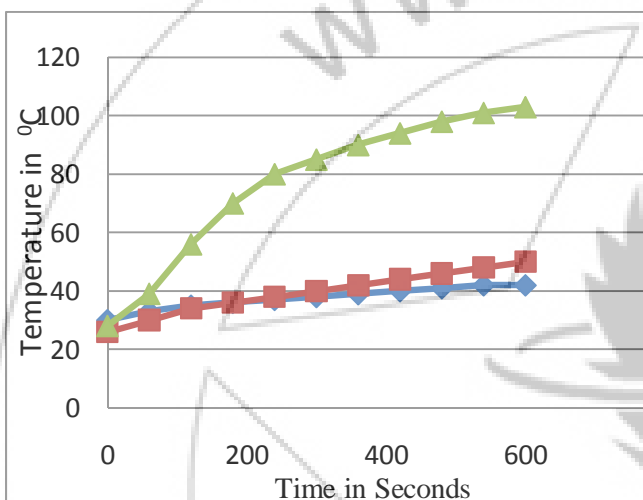


Figure 11: Temperature v/s Time for Aluminum

Table 5: Temperature of mild steel as a function of time for different lining materials

Sl. No.	Time in seconds	Temperature °C		
		Lining material		
		Neoprene Rubber	Wood	Grinding wheel
1	0	29	30	25
2	60	32	34	33
3	120	35	38	42
4	180	38	42	51
5	240	40	46	57
6	300	42	50	62
7	360	44	52	65
8	420	45	54	68
9	480	46	56	70
10	540	46	57	71
11	600	46	58	72

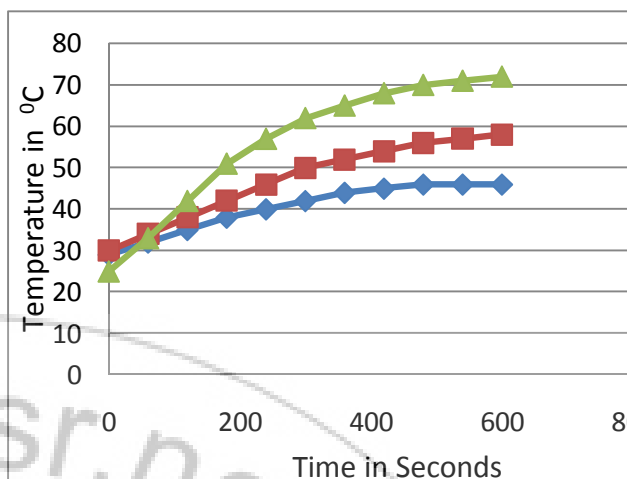


Figure 12: Temperature v/s Time for Mild steel

Table 6: Temperature of a cast iron as a function of time for different lining materials

Sl. No.	Time in seconds	Temperature °C		
		Lining material		
		Neoprene Rubber	Teak Wood	Grinding wheel
1	0	30	28	27
2	60	32	33	31
3	120	34	37	35
4	180	36	40	39
5	240	37	43	43
6	300	38	46	47
7	360	39	48	50
8	420	40	49	52
9	480	41	50	54
10	540	41	51	55
11	600	41	52	56

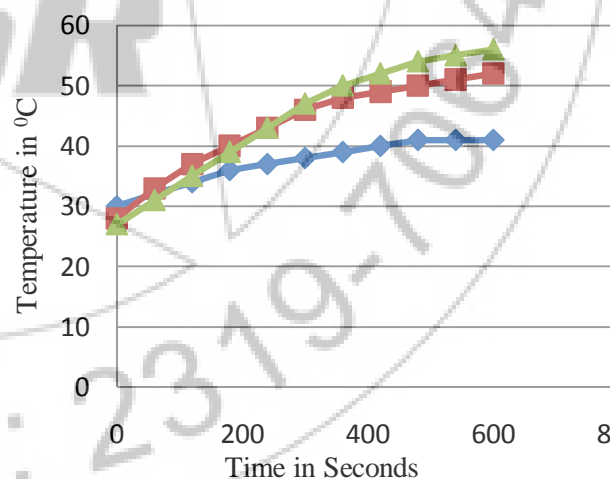


Figure 13: Temperature v/s Time for Cast iron

5. Conclusions

From the tests carried on different materials i.e., Aluminium, Mild steel and Cast iron the following conclusions were drawn:

- The wear rate (73.57E-6 N/s) was found high for cast iron because of its brittleness.

- The wear rate was high when the abrasive media used was coarse (GFN 24).
- The wear rate was high when grinding wheel was used as the lining material.
- For olivine sand of GFN 42, wear rate of all material tend to slow down at higher loads, since finer grains particles tends to slip through the mating surface without participating in wear.
- When grinding wheel was used with Aluminium specimen for all grain size of sands it was found that the wear reduces for higher loads. This was due to the aluminium particles getting embedded on the wheel.
- Temperature gradient was found to be the highest for Aluminium because of high thermal conductivity ($k=204\text{W/mK}$) compared to cast iron ($k=52\text{W/mK}$) and mild steel ($k=54\text{W/mK}$).

Jeevan T.P. received the B.E. degree in Mechanical Engineering from Malnad College of Engineering Hassan Karnataka in 2009 and M Tech in Computational Analysis in Mechanical Sciences in 2011. His areas of interest include Metal Cutting and Tribology. Presently working as an Assistant Professor in Malnad College of Engineering Hassan, Karnataka, India

5.1 Future Scope

Further the work can be extended for different lining materials as well as for different abrasives.

References

- [1] Amal Ebrahim Nassar and Eman Ebrahim Nassar, "Design and Fabrication of a Wear Testing Machine", Leonardo Electronic Journal of Practices and Technologies, Issue 19, pp. 39-48 July-December 2011.
- [2] J.M. Martin, Th. le Mogne, "Interpretation of friction and wear of ceramics in terms of surface analysis", Surf. Coat. Tech. 49 pp. 427-434. (1991)
- [3] D.M. Kennedy, M.S.J. Hashmi, "Methods of wear testing for advanced surface coatings and bulk materials", Journal of Materials Processing Technology (1998)
- [4] J.E. Kelley, J.J. Stiglich Jr., G.L. Sheldon, "Methods of characterization of tribological properties of coatings", Surf. Mod. Tech pp. 169-187. (1988).
- [5] K.J. Swick, G.W. Stachowiak, A.W. Batchelor, "Mechanism of wear of rotary percussive drilling bits and the effect of rock type on wear", Tribology Int.
- [6] B.J. Gill, "Designing and producing engineering surfaces, Recent Development in Surface Coating and Modification Processes", Union Carbide UK Ltd, 1985.
- [7] T.S. Eyre, "Friction and Wear Control in Industry", Surface Engineering Conference, Newcastle Upon Tyne, UK, 1992.
- [8] "Standard Test Method for Conducting Erosion Tests by Solid Particle Impingement Using Gas Jets.", Annual book of ASTM Standards, pp. 311-317, 1999.

Author Profile

Hareesha M. received the B.E. degree in Mechanical Engineering from Malnad College of Engineering Hassan Karnataka in 1999 and M Tech in Heat Power Engineering from NITK Suratkal in 2002. His areas of interest include Thermal Engineering, Fluid Mechanics, I.C.Engines and Turbo Machines. Presently working as an Assistant Professor in Malnad College of Engineering Hassan, Karnataka, India.