Experimental investigation of tribological properties of laser textured tungsten doped diamond like carbon coating under dry sliding conditions at various loads

By: Arslan, A (Arslan, A.)[1,2]; Masjuki, HH (Masjuki, H. H.)[2,3]; Quazi, MM (Quazi, M. M.)[2,4]; Kalam, MA (Kalam, M. A.)[2]; Varman, M (Varman, M.)[2]; Jamshaid, M (Jamshaid, M.)[2,5]; Rahman, SMA (Rahman, S. M. Ashrafur)[2,6]; Imran, M (Imran, M.)[7]; Zulfattah, ZM (Zulfattah, Z. M.)[2,8]; Anwar, MT (Anwar, M. T.)[1] ...More

View Web of Science ResearcherID and ORCID

MATERIALS RESEARCH EXPRESS
Volume: 6 **Issue:** 10
Article Number: 106444
DOI: 10.1088/2053-1591/ab408c
Published: OCT 2019
Document Type: Article
View Journal Impact

Abstract

Laser micro texturing technique has shown its potential in reducing friction and wear at various mechanical interfaces such as automotive and cutting tools etc. Automotive parts are coated with Diamond-like Carbon (DLC) coatings to enhance their performance. Due to stringent condition at the automotive contacts and demand for performance enhancement, increase in performance of DLC coatings is required. In this study laser micro texturing is being combined with tungsten doped DLC coating. In order to analyze the benefits of laser micro texturing on tungsten doped DLC coating. Tribological testing was conducted on a reciprocating test rig at various loading conditions. The results indicated that laser textured tungsten doped DLC coating showed the lower coefficient of friction compared to un-textured tungsten doped DLC coating at a load of 15 N, 25 N and 35 N. Higher graphitization was observed in the case of un-textured coating at 35 N load.

Keywords

Author Keywords: Laser surface texturing; Tungsten doped DLC; friction; wear
KeyWords Plus: WEAR REDUCTION; W-DLC; SURFACE; FRICTION; PERFORMANCE; CONTACT; TOOL; LUBRICATION; INTERFACE; BEHAVIOR

Author Information

Reprint Address: Arslan, A (reprint author)

COMSATS Univ Islamabad, Dept Mech Engn, Sahiwal Campus, Islamabad 57000, Pakistan.

Reprint Address: Arslan, A (reprint author)

Univ Malaya, Dept Mech Engn, Kuala Lumpur 50603, Malaysia.

Addresses:

[1] COMSATS Univ Islamabad, Dept Mech Engn, Sahiwal Campus, Islamabad 57000, Pakistan

[2] Univ Malaya, Dept Mech Engn, Kuala Lumpur 50603, Malaysia

[3] IIUM, Fac Engn, Dept Mech Engn, Kuala Lumpur 50728, Malaysia

[4] Univ Malaysia Pahang, Fac Mech & Mfg Engn, Pekan 26600, Pahang, Malaysia

[5] Bahauddin Zakariya Univ, Dept Mech Engn, Multan 60000, Pakistan

[6] Queensland Univ Technol, Brisbane, Qld, Australia

[7] Aston Univ, Sch Engn & Appl Sci, Mech Engn & Design, Birmingham B4 7ET, W Midlands, England

[8] Univ Teknikal Malaysia Melaka, Fak Kejuruteraan Mekanikal, Ctr Adv Res Energy CARe, Ayer Keroh 75450, Melaka, Malaysia

[9] Bayero Univ, Fac Engn, Dept Mech Engn, Kano 3011, Nigeria

E-mail Addresses: Arslanahmad@cuisahiwal.edu.pk

Funding

Funding Agency	Grant Number
Ministry of Higher Education (MOHE) of Malaysia for HIR-MOHE project	UMC/HIR/MOHE/ENG/60

View funding text

Publisher

IOP PUBLISHING LTD, TEMPLE CIRCUS, TEMPLE WAY, BRISTOL BS1 6BE, ENGLAND

Journal Information

Impact Factor: Journal Citation Reports

Categories / Classification

Research Areas: Materials Science

Web of Science Categories: Materials Science, Multidisciplinary

See more data fields

Cited References: 54

Showing 30 of 54 **View All in Cited References page** *(from Web of Science Core Collection)*

1. **Friction and Temperature Reduction in a Mechanical Face Seal by a Surface Texturing: Comparison between TEHD Simulations and Experiments** — Times Cited: 4
By: Adjemout, M.; Brunetiere, N.; Bouyer, J.
TRIBOLOGY TRANSACTIONS Volume: 61 Issue: 6 Pages: 1084-1093 Published: NOV 2 2018

2. **An overview of geometrical parameters of surface texturing for piston/cylinder assembly and mechanical seals** — Times Cited: 31
By: Ahmed, Arslan; Masjuki, H. H.; Varman, M.; et al.
MECCANICA Volume: 51 Issue: 1 Pages: 9-23 Published: JAN 2016

3. **Improvement in the tribological characteristics of Si-DLC coating by laser surface texturing under oil-lubricated point contacts at various temperatures** — Times Cited: 37
By: Amanov, Auezhan; Watabe, Tsukasa; Tsuboi, Ryo; et al.
SURFACE & COATINGS TECHNOLOGY Volume: 232 Pages: 549-560 Published: OCT 2013

4. **Surface Texture Manufacturing Techniques and Tribological Effect of Surface Texturing on Cutting Tool Performance: A Review** — Times Cited: 31
By: Arslan, A.; Masjuki, H. H.; Kalam, M. A.; et al.
CRITICAL REVIEWS IN SOLID STATE AND MATERIALS SCIENCES Volume: 41 Issue: 6 Pages: 447-481 Published: 2016

5. **Wear characteristics of patterned and un-patterned tetrahedral amorphous carbon film in the presence of synthetic and bio based lubricants** — Times Cited: 1
By: Arslan, A.; Quazi, M. M.; Masjuki, H. H.; et al.
MATERIALS RESEARCH EXPRESS Volume: 6 Issue: 3 Article Number: 036414 Published: MAR 2019

6. **Investigation of laser texture density and diameter on the tribological behavior of hydrogenated DLC coating with line contact configuration** — Times Cited: 8
By: Arslan, A.; Masjuki, H. H.; Kalam, M. A.; et al.
SURFACE & COATINGS TECHNOLOGY Volume: 322 Pages: 31-37 Published: AUG 15 2017

7. **Performance of DLC coated tool during machining of MDN431 alloyed steel** — Times Cited: 4
By: Badiger, Pradeep V.; Desai, Vijay; Ramesh, M. R.
MATERIALS TODAY-PROCEEDINGS Volume: 5 Issue: 9 Special Issue: SI Pages: 17360-17370 Part: 1 Published: 2018

8. **Effect of laser surface texturing on friction behaviour in elastohydrodynamically lubricated point contacts under different sliding-rolling conditions** — Times Cited: 3
By: Boidi, G.; Tertuliano, I.S.; Profito, F.J.; et al.
Tribol. Int. Published: 2019
[Show additional data]

9. **DLC and DLC-WS2 Coatings for Machining of Aluminium Alloys** — Times Cited: 1
By: Brzezinka, Tomasz L.; Rao, Jeff; Paiva, Jose M.; et al.
COATINGS Volume: 9 Issue: 3 Article Number: 192 Published: MAR 15 2019

10. **Multi-objective optimization of micron-scale surface textures for the cylinder/valve plate interface in axial piston pumps** — Times Cited: 2
By: Chen, Yuan; Zhang, Junhui; Xu, Bing; et al.
TRIBOLOGY INTERNATIONAL Volume: 138 Pages: 316-329 Published: OCT 2019

11. **Manufacturing textured surfaces: State of art and recent developments** — Times Cited: 46
By: Coblas, Daniela G.; Fatu, Aurelian; Maoui, Abdelghani; et al.
PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS PART J-JOURNAL OF ENGINEERING TRIBOLOGY Volume: 229 Issue: 1 Pages: 3-29 Published: JAN 2015

12. **Femto second laser surface texturing of titanium as a method to reduce the adhesion of Staphylococcus aureus and biofilm formation** — Times Cited: 66
By: Cunha, Alexandre; Elie, Anne-Marie; Plawinski, Laurent; et al.
APPLIED SURFACE SCIENCE Volume: 360 Pages: 485-493 Part: B Published: JAN 1 2016

13. **Improved Tribological Behavior of DLC Films Under Water Lubrication by Surface Texturing** — Times Cited: 50
By: Ding, Qi; Wang, Liping; Wang, Yongxin; et al.
TRIBOLOGY LETTERS Volume: 41 Issue: 2 Pages: 439-449 Published: FEB 2011

14. Title: [not available] — Times Cited: 22
By: DONNET C
TRIBOLOGY DIAMOND LI Pages: 1 Published: 2008

15. **Valvetrain Friction Reduction through Thin Film Coatings and Polishing** — Times Cited: 19
By: Gangopadhyay, Arup; McWatt, Douglas G.; Zdrodowski, Robert J.; et al.
TRIBOLOGY TRANSACTIONS Volume: 55 Issue: 1 Pages: 99-108 Published: 2012

16. **Advanced DLC coating technique on silicone-based tubular medical devices** — Times Cited: 2
By: Gasab, Musab Timan Idriss; Uchiyama, Masahiro; Nakatani, Tatsuyuki; et al.
SURFACE & COATINGS TECHNOLOGY Volume: 307 Pages: 1084-1087 Part: B Published: DEC 15 2016

17. **Status of surface modification techniques for artificial hip implants** — Times Cited: 17
By: Ghosh, Subir; Abanteriba, Sylvester
SCIENCE AND TECHNOLOGY OF ADVANCED MATERIALS Volume: 17 Issue: 1 Article Number: 735 Published: 2016

18. **Surface Texturing of Tribological Interfaces Using the Vibromechanical Texturing Method** — Times Cited: 58
By: Greco, Aaron; Raphaelson, Steven; Ehmann, Kornel; et al.
JOURNAL OF MANUFACTURING SCIENCE AND ENGINEERING-TRANSACTIONS OF THE ASME Volume: 131 Issue: 6 Article Number: 061005 Published: DEC 2009

19. **Effects of surface texturing on ring/liner friction under starved lubrication** — Times Cited: 48
By: Gu, Chunxing; Meng, Xianghui; Xie, Youbai; et al.
TRIBOLOGY INTERNATIONAL Volume: 94 Pages: 591-605 Published: FEB 2016

20. **A THEORY OF LUBRICATION BY MICRO-IRREGULARITIES** — Times Cited: 222
By: HAMILTON, DB; WALOWIT, JA; ALLEN, CM
JOURNAL OF BASIC ENGINEERING Volume: 88 Issue: 1 Pages: 177-& Published: 1966

21. **Improving tribological properties of titanium alloys by combining laser surface texturing and diamond-like carbon film** — Times Cited: 88
By: He, Dongqing; Zheng, Shaoxian; Pu, Jibin; et al.
TRIBOLOGY INTERNATIONAL Volume: 82 Pages: 20-27 Part: A Published: FEB 2015

22. **Research on discriminating partition laser surface micro-texturing technology of engine cylinder** — Times Cited: 29
By: Hua, Xijun; Sun, Jianguo; Zhang, Peiyun; et al.
TRIBOLOGY INTERNATIONAL Volume: 98 Pages: 190-196 Published: JUN 2016

23. **Influence of coatings and surface improvements on the lifetime of gears** — Times Cited: 14
By: Joachim, F.; Kurz, N.; Glatthaar, B.
Gear Technol. Volume: 21 Pages: 50-56 Published: 2004

24. **Influence of a micropatterned insert on characteristics of the tool-workpiece interface in a hard turning process** — Times Cited: 32
By: Kim, Dong Min; Lee, Ineon; Kim, Sun Keel; et al.
JOURNAL OF MATERIALS PROCESSING TECHNOLOGY Volume: 229 Pages: 160-171 Published: MAR 2016

25. **Performance of electrical discharge textured cutting tools** — Times Cited: 103
By: Koshy, P.; Tovey, J.
CIRP ANNALS-MANUFACTURING TECHNOLOGY Volume: 60 Issue: 1 Pages: 153-156 Published: 2011

26. **The combined effect of surface texturing and DLC coating on the functional properties of internal combustion engines** — Times Cited: 8
By: Koszela, Waldemar; Pawlus, Pawel; Reizer, Rafal; et al.
TRIBOLOGY INTERNATIONAL Volume: 127 Pages: 470-477 Published: NOV 2018

27. **Tribological behavior of nanosecond-laser surface textured Ti6Al4V** — Times Cited: 5
By: Kuemmel, Daniel; Hamann-Schroer, Marcus; Hetzner, Harald; et al.
WEAR Volume: 422 Pages: 261-268 Published: MAR 15 2019

28. **The influence of textured interface on DLC films prepared by vacuum arc** — Times Cited: 1
By: Liu, X.; Zhang, W.; Sun, G.
SURFACE & COATINGS TECHNOLOGY Volume: 365 Special Issue: SI Pages: 143-151 Published: MAY 15 2019

29. **A Critical Review on Physical Vapor Deposition Coatings Applied on Different Engine Components** — Times Cited: 7
By: Mehran, Q. M.; Fazal, M. A.; Bushroa, A. R.; et al.
CRITICAL REVIEWS IN SOLID STATE AND MATERIALS SCIENCES Volume: 43 Issue: 2 Pages: 158-175 Published: 2018

30. **DLC-W coatings tested in combustion engine - Frictional and wear analysis** — Times Cited: 22
By: Mutafov, P.; Lanigan, J.; Neville, A.; et al.
SURFACE & COATINGS TECHNOLOGY Volume: 260 Pages: 284-289 Published: DEC 15 2014

Showing 30 of 54 **View All in Cited References page**