Frontiers in Magnetic Recording Research: Towards 10 Terabits/In^2

Professor Charanjit Singh Bhatia (Retired)
Fellow ASME and IEEE

Affiliations
Spin & Energy Lab (SEL), ECE Department, National University of Singapore (NUS), Singapore.
IBM/HitachiGST, San Jose, CA; UC Berkeley (Faculty Loan Program & Visiting Industrial Fellow), Berkeley, CA

exit_ibm@yahoo.com

Abstract

In the last 40 years or so, magnetic data storage systems have had a blistering pace of increase (~10^9 x) in areal density contributing to the digital revolution. In this talk the author will share insights from his journey building cutting edge technology for over 40 years, exemplified by the development of Hard Disk Drives (HDDs) and their impact on today's internet-driven world. He will focus on one of the key enablers of high data storage density, namely, Head/Media spacing. Read back signal and bit resolution improves with reduction in magnetic spacing. Tetrahedral amorphous carbon (ta-C) or sometimes called Diamond-like carbon (dlc) film is used as a protective layer on the magnetic heads and media for wear and corrosion protection [1, 2]. However, dlc film loses its efficacy below ~2-3 nm thickness [1,2]. Graphene is explored as an alternative protective overcoat not only for the current technology but also for its thermal stability required for Heat Assisted Magnetic Recording (HAMR) [3, 4]. Results from our work on one to four layers of Graphene as a protective overcoat in a hard disk application will be presented [3]. See Figure 1 below.

References

[1] Neeraj Dwivedi, Reuben J. Yeo, Leonard, J. K. Yak, Nalam Satyanarayana, Chetna Dhand, Thirumaleshwara N. Bhat, Zheng Zhang, Chetna Dhand, S. Tripathy, C. S. Bhatia, ACS Applied Materials and Interfaces 2016, 8, 17606-17621.
[2] Shreya Kundu, Neeraj Dwivedi, Nalam Satyanarayana, Reuben J. Yeo, Joachim Ahner, Paul M. Jones, C. S. Bhatia, ACS Applied materials and Interfaces 2015, 7, 158-165.
[3] Neeraj Dwivedi, A. K. Ott, K. Sasikumar, C. Dou, R. J. Yeo, B. Narayanan, U. Sassi, D. De Fazio, G. Soavi, T. Dutta, O. Balci, S. Shinde, J. Zhang, A. K. Katiyar, P. S. Keatley, A. K. Srivastava, S.K.R.S. Sankaranarayanan, A. C. Ferrari, C. S. Bhatia, Nature Communications 2021, 12, 3437.
[4] Mark H. Kryder; Edward C. Gage; Terry W. McDaniel; William A. Challener; Robert E. Rottmayer; Ganping Ju, Proc. IEEE 96, 1810–1835 (2008).

Figures

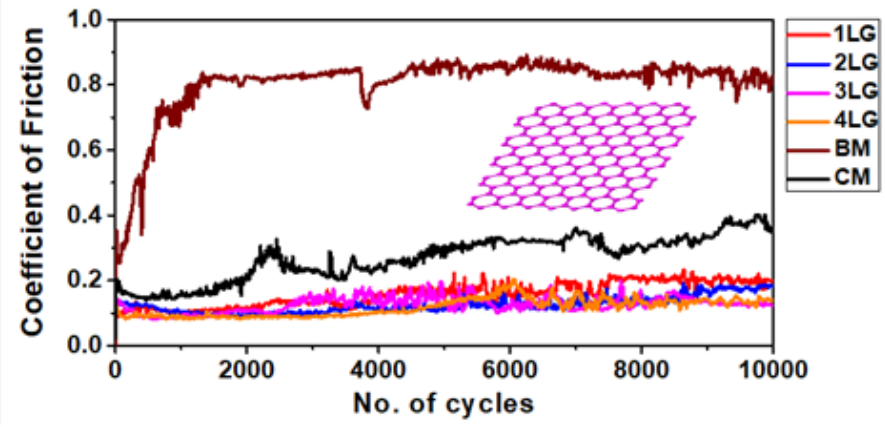

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Figure 1: Coefficient of Friction and Wear of Graphene Vs DLC coated and bare Magnetic Media