

Green Nanotribology - Challenges, Development and Opportunities

I.C. Gebeshuber^{1,2,3,*} and B.Y. Majlis¹

¹ Department of Microengineering and Nanoelectronics,
Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia

² Institute of Applied Physics, Vienna University of Technology,
1040 Wien, Austria, Europe

³ AC²T Austrian Center of Competence for Tribology,
Wiener Neustadt, Austria, Europe

*Corresponding author: E-mail: gebeshuber@iap.tuwien.ac.at, ille.gebeshuber@mac.com,
Phone: +60 13 319 85 88, Fax: +60 3 8925 0439

Current nanotribology is analyzed regarding its potential to go green, and promises and possible pitfalls of such an approach are presented.

Green nanotribology is sustainable technology dealing with friction, wear and lubrication of interacting surfaces in relative motion at the nanometer scale. Green nanotribology includes biomimetic tribological nanotechnology, sustainable control of friction, wear and lubrication on the nanoscale, environmental aspects of nanoscale lubrication layers, environmental aspects of nanotechnological surface modification techniques and nanotribological aspects of green applications such as artificial photosynthesis. Green nanotribology shall be able to provide technical support to preservation of resource and energy and to propel the society forward towards sustainability.

Green nanotribology aspects comprising nanostructured surfaces, nanoagents and nanoprocesses are dealt with in the light of three questions:

How can processes get greener with nanotribology?

How can we prevent that such processes turn worse because of adverse chemical reactions?

How can we prevent that the resulting green nanotribology is not only pseudo-green and negative impact on the environment and biology is only translated to other layers?

Various biological systems, structures and processes, where green nanotribology is omnipresent, are introduced as best practice examples to address the above questions and establish a path towards sustainable green nanotribology.

Gebeshuber, I.C., Abdel-Aal, H.A., Majlis, B.Y. and Stachelberger, H. (in press)
'Biomimetics in tribology', In: 'Biomimetics - Materials, structures and processes. examples, ideas and case studies', Eds: Bruckner D. *et al.*, Series: Biological and Medical Physics, Biomedical Engineering, Springer Publishing, Series Editor Claus Ascheron, 2011.

Gebeshuber, I.C., Gruber, P. and Drack, M. (2009) 'A gaze into the crystal ball - biomimetics in the year 2059', Proc. IMechE Part C: J. Mech. Eng. Sci., Vol. 223, No. 12, pp. 2899-2918.

Gebeshuber I.C., Drack M. and Scherge M. (2008) 'Tribology in biology', Tribology - Surfaces, Materials and Interfaces, Vol. 2, No. 4, pp. 200-212