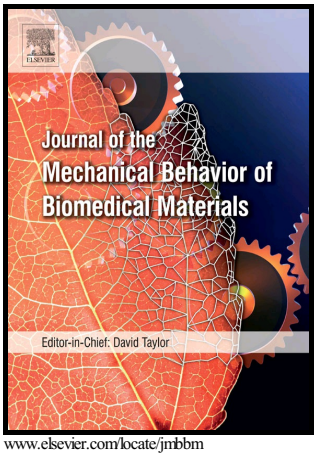

www.elsevier.com/locate/jmbbm

Nanotribological response of a plasma nitrided bio-steel

Aniruddha Samanta, Himel Chakraborty, Manjima Bhattacharya, Jiten Ghosh, Monjoy Sreemany, Sandip Bysakh, Ramkrishna Rane, Alphonsa Joseph, Ghanshyam Jhala, Subroto Mukherjee, Mitun Das, Anoop K. Mukhopadhyay

PII: S1751-6161(16)30323-X
DOI: http://dx.doi.org/10.1016/j.jmbbm.2016.09.017
Reference: JMBBM2073

To appear in: *Journal of the Mechanical Behavior of Biomedical Materials*

Received date: 23 May 2016
Revised date: 26 July 2016
Accepted date: 11 September 2016

Cite this article as: Aniruddha Samanta, Himel Chakraborty, Manjima Bhattacharya, Jiten Ghosh, Monjoy Sreemany, Sandip Bysakh, Ramkrishna Rane, Alphonsa Joseph, Ghanshyam Jhala, Subroto Mukherjee, Mitun Das and Anoop K. Mukhopadhyay, Nanotribological response of a plasma nitrided bio steel, *Journal of the Mechanical Behavior of Biomedical Materials* http://dx.doi.org/10.1016/j.jmbbm.2016.09.017

Nanotribological response of a plasma nitrided bio-steel

Aniruddha Samanta[a] , Himel Chakraborty[a], Manjima Bhattacharya[a], Jiten Ghosh[a], Monjoy Sreemany[a], Sandip Bysakh[b], Ramkrishna Rane[c], Alphonsa Joseph[c], Ghanshyam Jhala[c], Subroto Mukherjee[c], Mitun Das[d], Anoop K. Mukhopadhyay[a*]

[a]Advanced Mechanical and Material Characterization Division, CSIR-Central Glass and Ceramics Research Institute, Kolkata 700 032, India; [b]Advanced Material Characterization Unit, CSIR-Central Glass and Ceramics Research Institute, Kolkata 700 032, India; [c]Facilitation Centre for Industrial Plasma Technologies, Institute for Plasma Research, Gandhinagar 382 428, India; [d]Bioceramics and Coating Division, CSIR-Central Glass & Ceramic Research Institute, 196 Raja S. C. Mullick Road, Kolkata 700032, India.

Abstract

AISI 316L is a well known biocompatible, austenitic stainless steel (SS). It is thus a bio-steel. Considering its importance as a bio-prosthesis material here we report the plasma nitriding of AISI 316L (SS) followed by its microstructural and nanotribological characterization. Plasma nitriding of the SS samples was carried out in a plasma reactor with a hot wall vacuum chamber. For ease of comparison these plasma nitrided samples were termed as SSPN. The experimental results confirmed the formations of an embedded nitrided metal layer zone (ENMLZ) and an interface zone (IZ) between the ENMLZ and the unnitrided bulk metallic layer zone (BMLZ) in the SSPN sample. These ENMLZ and IZ in the SSPN sample were richer in iron nitride (FeN) chromium nitride (CrN) along with the austenite phase. The results from nanoindentation, microscratch, nanoscratch and sliding wear *studies* confirmed that the static contact deformation resistance, the microwear, nanowear and sliding wear resistance of the SSPN samples were much better than those of the SS samples. These results were explained in terms of structure-property correlations.

Keywords: *Steel; Plasma nitriding; Nanoindentation; Hardness; Scratch*

Corresponding Author: Tel.: +91 33 2473 3469/76/77/96; **fax:** +91 33 2473 0957; **Present address:** Central Glass and Ceramic Research Institute, 196, Raja S.C. Mullick Road, Kolkata-32, **E-mail address:** anoopmukherjee@cgcri.res.in, mukhopadhyay.anoop@gmail.com
Authors E-mail address- aniruddha.chm@gmail.com, himelchakraborty@gmail.com, mbmanjima7@gmail.com, jiten@cgcri.res.in, m_sreemany@cgcri.res.in, sbysakh@cgcri.res.in, ramkrishna.rane@gmail.com, alphonsa@ipr.res.in, mukherji@ipr.res.in, anoopmukherjee@cgcri.res.in