



AN 352 Diamond Like Carbon (DLC) Distribution on a Magnetic Head Surface

May 7, 2007 (Version 3.0)

Discussion

Carbon is used as a protective coating on magnetic recording disks and heads (as well as other industrial products). The thin carbon layer (5 - 10 nm) contains a significant concentration of sp^3 hybridized carbon that results in a hardness equivalent to 40% of that of diamond, thus its name, diamond like carbon (DLC). Layer thickness, uniformity and composition have to be carefully controlled in the carbon coating to produce the desired hardness and wear resistance. Raman spectroscopy can determine the layer thickness uniformity by mapping (imaging) the Raman scattering from the carbon layer.

A magnetic head surface was scanned by Raman micro-spectroscopy (Figure 1). The spectrum from a one micrometer spot, acquired using an Ar⁺ ion laser (514.5 nm) is shown in Figure 2. Two broad bands, the carbon D-band ($\sim 1347\text{ cm}^{-1}$) and the carbon G-band ($\sim 1585\text{ cm}^{-1}$), can also be used for the evaluation of DLC hardness. The total peak areas of these bands ($1200\text{-}1800\text{ cm}^{-1}$) are considered proportional to the carbon concentration (layer thickness) of each individual spot.

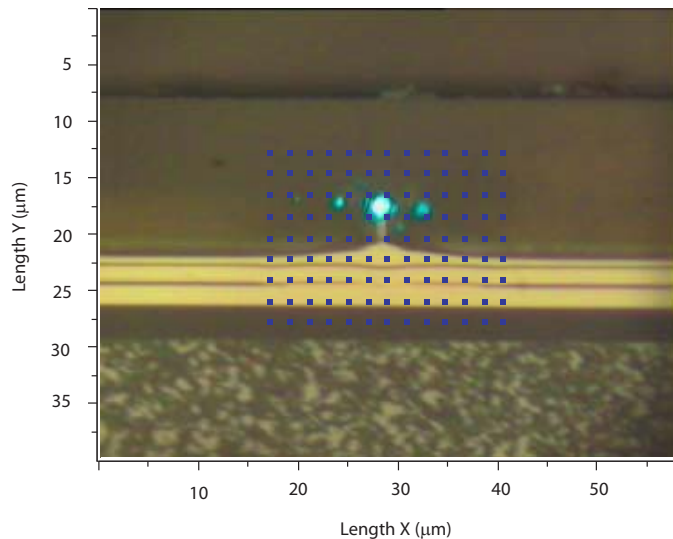


Figure 1. Head surface showing Raman analysis areas

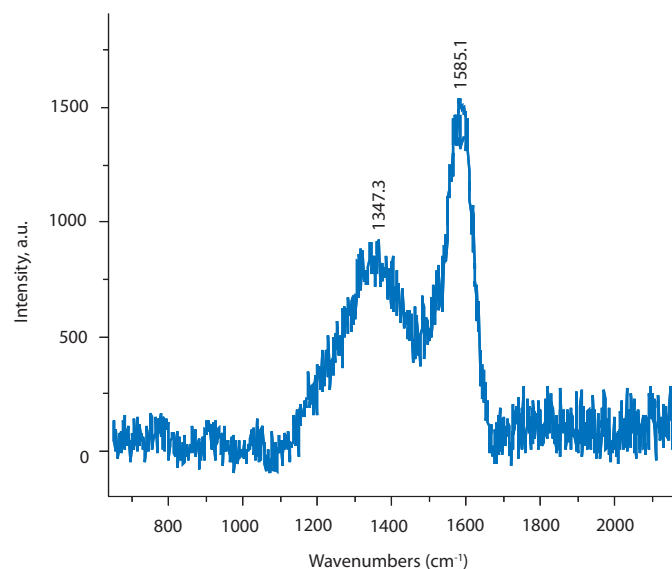


Figure 2. Carbon region of Raman spectrum from magnetic head

The Raman intensities from the one micrometer spots in the area are mapped in a 3D plot (Figure 3). A Raman image of the carbon distribution is shown in Figure 4. The carbon concentration (layer thickness) is lowest in red areas and highest in blue areas.

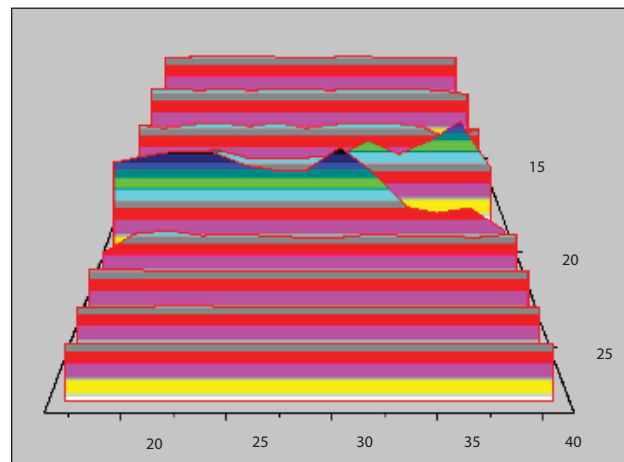


Figure 3. 3D plot of carbon intensity

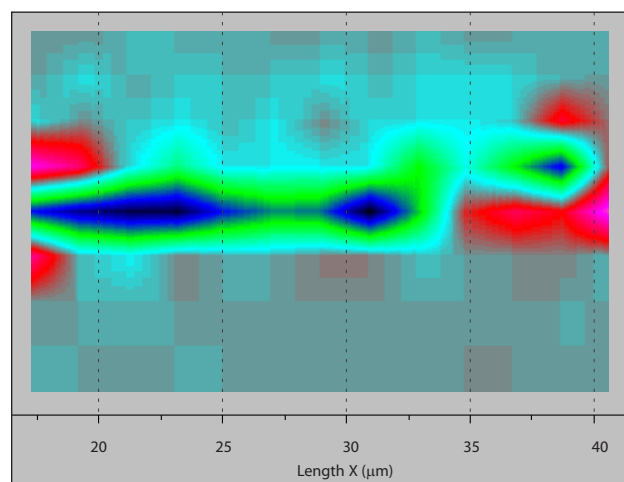


Figure 4. Areas of high (blue) and low (red) C concentration

United States Locations

Tempe, Arizona
+1 480 239 0602 info.az@eaglabs.com
+1 602 470 2655 fax

Sunnyvale, California
810 Kifer Road
+1 408 530 3500 info.ca@eaglabs.com
+1 408 530 3501 fax

1135 E Arques Avenue
+1 408 738 3033
+1 408 738 3035 fax

785 Lucerne Drive
+1 408 737 3892
+1 408 737 3916 fax

Peabody, Massachusetts
+1 978 278 9500 info.ma@eaglabs.com
+1 978 278 9501 fax

Chanhassen, Minnesota
+1 952 828 6411 info.mn@eaglabs.com
+1 952 828 6449 fax

East Windsor, New Jersey
+1 609 371 4800 info.nj@eaglabs.com
+1 609 371 5666 fax

Syracuse, New York
+1 315 431 9900 info.ny@eaglabs.com
+1 315 431 9800 fax

Raleigh, North Carolina
+1 919 829 7041 info.nc@eaglabs.com
+1 919 829 5518 fax

Round Rock, Texas
+1 512 671 9500 info.tx@eaglabs.com
+1 512 671 9501 fax

International Locations

Shanghai, China
+ 86 21 6879 6088 info.cn@eaglabs.com
+ 86 21 6879 9086 fax

Tournefeuille, France
+ 33 5 61 73 15 29 info.fr@eaglabs.com
+ 33 5 61 73 15 67 fax

Frankfurt, Germany
+ 49 (0) 693053213 info.de@eaglabs.com
+ 49 (0) 69307941 fax

Tokyo, Japan
+ 81 3 5396 0531 info.jp@eaglabs.com
+ 81 3 5396 1930 fax

HsinChu, Taiwan
+ 886 3 5632303 info.tw@eaglabs.com
+ 886 3 5632306 fax

Uxbridge, United Kingdom
+ 44 (0) 1895 811194 info.uk@eaglabs.com
+ 44 (0) 1895 810350 fax