This is a repository copy of *In situ XPS and NEXAFS investigation of the thermally-induced structural evolution of advanced amorphous carbonbased surfaces.*

White Rose Research Online URL for this paper:
http://eprints.whiterose.ac.uk/91834/

Version: Accepted Version

**Proceedings Paper:**

---

**Reuse**
Unless indicated otherwise, fulltext items are protected by copyright with all rights reserved. The copyright exception in section 29 of the Copyright, Designs and Patents Act 1988 allows the making of a single copy solely for the purpose of non-commercial research or private study within the limits of fair dealing. The publisher or other rights-holder may allow further reproduction and re-use of this version - refer to the White Rose Research Online record for this item. Where records identify the publisher as the copyright holder, users can verify any specific terms of use on the publisher’s website.

**Takedown**
If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.
Silicon oxide-doped diamond-like carbon (SiO_x-DLC) coatings are fully amorphous thin-film materials consisting of two interpenetrating networks, one being a hydrogenated amorphous carbon (a-C:H) network and the other a silica glass (SiO_x) network. At temperatures above 150°C, pure a-C:H films undergo a rapid degradation that starts with the evolution of hydrogen and is followed by the conversion of sp³ bonds to sp². However, SiO_x-DLC exhibits much lower susceptibility to oxidative degradation, and much higher thermal stability compared to a-C:H. This makes SiO_x-DLC an attractive material for many applications, including for the development of next generation hard disk drives, which require novel overcoat materials that are thermally stable up to temperatures above 500°C. Even though it is well-established that SiO_x-DLC possesses superior thermal stability and oxidation resistance relative to a-C:H, the scientific basis for this behavior is not understood. To investigate this, a combined in situ XPS and NEXAFS study was performed. Changes in the surface chemistry and bonding configuration of SiO_x-DLC (e.g., silicon oxidation state, carbon hybridization state) could be accessed in situ at temperatures up to 450°C. A novel methodology for processing NEXAFS spectra, which makes it possible to account for the presence of a carbonaceous contamination layer on an air-exposed material, was developed. This allowed quantitative evaluation of the carbon hybridization state in the film as a function of the annealing temperature. These experimental results could be well fit with a thermally activation-based model that describes the structural transformations occurring in vacuum in SiO_x-DLC as a function of time and temperature. To determine the environmental dependence of the surface structural evolution of SiO_x-DLC, the results of the in situ XPS/NEXAFS investigation were compared to those for SiO_x-DLC samples heated in air, showing a strong effect of atmospheric oxygen.