

Technical University of Denmark



## Investigation of Plasma Effects in Ultra High Molecular Weight Polyethylene (UHMWPE) Cords

Teodoru, Steluta; Kusano, Yukihiro; Rozlosnik, Noemi; Michelsen, Poul

*Publication date:*  
2008

[Link back to DTU Orbit](#)

### *Citation (APA):*

Teodoru, S., Kusano, Y., Rozlosnik, N., & Michelsen, P. (2008). Investigation of Plasma Effects in Ultra High Molecular Weight Polyethylene (UHMWPE) Cords. Abstract from Danish Physical Society Annual Meeting 2008, Nyborg Strand, Denmark.

**DTU Library**  
Technical Information Center of Denmark

---

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

## Investigation of Plasma Effects in Ultra High Molecular Weight Polyethylene (UHMWPE) Cords

By Steluta Teodoru (1)

and

Yukihiro Kusano (1), Noemi Rozlosnik (2) and Poul K. Michelsen

(1)

(1)Optics and Plasma Research Department, Risø National Laboratory for Sustainable Energy

Technical University of Denmark, DK-4000 Roskilde, Denmark

(2)Department of Micro- and Nanotechnology, Technical University of Denmark,

DK-4000 Roskilde, Denmark

Presentation type: talk

---

Ultra-high-molecular-weight polyethylene (UHMWPE) has been widely used because of its high chemical stability, high impact strength, flexibility and low cost. Its field of applications includes use in composites, packing for microelectronic components and biomaterials, usually requiring its surface modification for improved wetting and/or adhesion with other polymeric materials. Atmospheric pressure plasma treatment is promising for this purpose due to its environmental compatibility, high treatment effects without affecting the textural characteristics of the bulk material, its applicability to a variety of shapes, and easy up-scaling and construction of in-line production processes.

An atmospheric pressure dielectric barrier discharge (DBD) plasma is used to study surface modification effect on UHMWPE cords, operated at a frequency of ca. 40 kHz in He, He/O<sub>2</sub>, O<sub>2</sub> and N<sub>2</sub> gases. The cords were continuously treated by the plasma with an exposure time of 5-20 s. The plasma is diagnosed by optical emission spectroscopy, while the treated UHMWPE cords are characterized using Fourier transform infrared spectroscopy, core and valence-band X-ray photoelectron spectroscopy (XPS), and atomic force microscopy. Core XPS results indicate the formation of carboxylic (COOH, COOR), carbonyl (C=O), ether (C-O-C) epoxide (cyclic ether), acetal (O-C-O) and hydroxylic (OH) groups at the surface after the treatment, but can not quantitatively distinguish between epoxide and hydroxylic groups. Valence-band XPS spectra are more sensitive to the differences in the surface functionality than core region spectra, being a useful tool for the estimation of the epoxide and hydroxylic group concentrations at the surface. The surface modification mechanism will be extensively discussed in terms of the plasma conditions, referring the application for adhesion improvement.