Human *Stratum Corneum Epidermidis* modification by means of atmospheric-pressure cold plasma treatment

D. Athanasopoulos, P. Svarnas

University of Patras, Electrical & Computer Eng. Dept., High Voltage Lab., 26504 Rion, Patras, Greece

In the frame of the emerging field of plasma medicine, the present work is devoted to human *stratum corneum epidermidis* modification by means of a sinusoidal-driven helium "plasma jet" (train of "guided streamers"). *Stratum Corneum* is the outermost layer of the epidermis and thus it plays the role of a barrier to protect the underlying tissues. Accordingly, and due to its composition, it exhibits highly hydrophobic nature and any drug delivery through skin is subjected to this barrier. Hereby, it is clearly demonstrated the possibility of increasing human *stratum corneum epidermidis* wettability as a function of the exposure time to plasma-induced reactive species.

1. Introduction

Plasma medicine is emerging world-wide as a new field of medical research, with special applications to dermatology. Towards this direction, human *stratum corneum epidermidis* (SCE) is here subjected to atmospheric-pressure cold plasma (APCP) treatment for increasing wettability.

SCE has the architecture of dead keratin filled cells in a lipid matrix [1]. Its thickness lies typically from 10 to 20 μm, and it functions to protect the underlying tissues. The wettability of human skin varies significantly depending on the anatomical site, the pre-conditioning (e.g. soap washing, water rinsing etc) [2] etc. However, clean human skin is hydrophobic, since it exhibits water contact angles (WCAs) up to 125 deg [2].

In this work, the wettability of SCE is reduced using a He APCP, sinusoidially driven at 10 kHz.

2. Experimental setup and specimens

The reactor used for APCP production and the plasma interpretation in respect to biological applications, have been presented elsewhere [3]. The SCE samples are from the breast of a 63-years old Caucasian female (BMI 27) and supplied from Biopredic International. Briefly, the samples are de-frozen, immersed in phosphate buffered saline, pH 7.4, rinsed gently by ultrapure water, and their surface is dried carefully under weak flow of Ar gas. The wettability of the samples is evaluated with WCAs (drops of 3 μl) due to a motorized drop shape analysis system (Krüss GmbH; EasyDrop). The experiments are realized in triplicates, providing mean values and standard deviations.

3. Results and Discussion

Fig. 1 depicts the SCE wettability evolution for increasing plasma treatment.

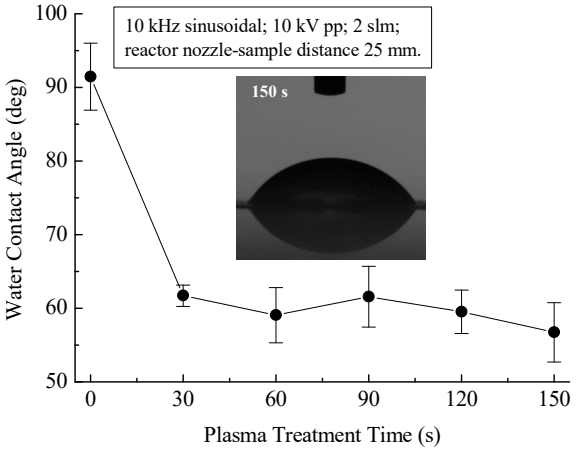

Fig. 1: Human *Stratum Corneum Epidermidis* wettability versus the exposure time to APCP.

Following XPS analysis (not shown here) and plasma probing [3], the WCA decrease down to 56 deg is attributed to surface functionalization induced by plasma-generated RONS.

4. Conclusions

APCP was here proposed as an efficient medium for SCE wettability increase, which in turns could be useful for therapeutic gel applications.

5. References

[1] C. L. Silva et al., Biochim. Biophys. Acta **1768** (2007) 2647-2659.

[2] M. E. Ginn et al., J. Colloid Interface Sci. **26** (1968) 146-151.

[3] P. Svarnas et al., Appl. Phys. Lett. **101** (2012) 264103.

Acknowledgments

D.A. acknowledge I.K.Y. (State Scholarships Foundation; NSRF 2014-2020) for financial support.