Atmospheric Plasma Jet Exposures: Beyond the Skin

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The primary function of the epidermis is the production of the Stratum Corneum (SC) that effectively protects our body from desiccation even in dry environment as well as from external invasion of injurious agents, although it is a thin (less that 20 µm thick) biological barrier membrane [1]. The SC is comprised of two-compartment system of corneocytes, flattened dead cell bodies of epidermal keratinocytes and intercellular lipid lamellae.
The field of plasma health care is now the subject of a broad interdisciplinary research effort involving medicine, biology, physics, chemistry and engineering [2]. A huge number of works have been dedicated to the understanding of the mechanisms involved during cold atmospheric plasma skin exposition by exploring deeper layers than the SC itself. Surprisingly, there is a poor interest in studies relating to interactions which may occur in the near-surface region (i.e. ~ 10nm depth) of the SC. Such understanding is essential in a fundamental point of view but also present great interests for cosmetic applications.

In this work, we concentrate our efforts to characterize the physicochemical modifications of SC after exposition to helium atmospheric plasma jets. We work with sheets of SC isolated from normal skin and usual surface characterization tools as IR, Raman, XPS are used. Besides equilibrium proton-transfer reactions are used as probes [3] to define in a fundamental point of view the nature of the plasma interactions with the surface of stratum corneum.
The helium plasma jet is produced by using a pulsed high voltage power supply consisting in chopping a 10kHz sinusoidal waveform. Plasma jets at mean temperature closed to the room temperature are thus formed and contain numerous reactive oxygen and nitrogen species (ROS and RNS). Distance between SC samples and the jet and exposures times are modified in order to analyse physico-chemical modifications.

References

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