OR0708

Etching of biomolecules and polymers by low-temperature atmospheric pressure plasma jet investigated by in-situ ellipsometry

Ondrej Kylian, Artem Shelemin, Jaroslav Kousal, Jan Hanus, Mykhailo Vaidulych, Hynek Biederman

Charles University in Prague, Prague 8, Czech Republic

ondrej.kylian@gmail.com

The residual biological contaminants on the reused medical instruments represent serious risk for the health of patients. Unfortunately, it has been repeatedly shown that the commonly used sterilization methods are unable to assure complete elimination or inactivation of various kinds of pathogens. From this point of view one of the most rapidly developing and promising methods to overcome this unfavorable situation are the ones based on the use of non-equilibrium plasmas, especially the ones operated at atmospheric pressure. For successful application and optimization of such plasmas is crucial to find relations between the etching rates on one hand and parameters of processing plasma and structure of treated biomolecules on the second hand.
In this study, a real-time, in-situ ellipsometric characterization of etching capability of low□temperature atmospheric plasma jet (APPJ) operated in argon is presented. Biomolecules (Bovine serum albumin, L-arginine) and polymeric films (sputtered Nylon, a-C:H) were used as model substances. It has been found that the removal efficiency of APPJ is strongly dependent on the properties of treated substance. The lowest etching rates were observed for dense a-C:H films (~ 1 nm/min) while the highest etching rates were measured for biomolecules (up to 100 nm/min). In addition, it has been observed that the etching process is not temporally stable. Non-linear, and at shorter distances between treated samples and nozzle of the plasma jet also non-monotonous, dependence of the removal rate on the treatment duration was observed. This behavior is most likely connected with two opposing effects: the formation of thin layer on the top of treated material, whose presence causes gradual decrease of removal efficiency, and slight heating of treated substances that facilitates their volatilization induced by chemically active radicals produced by the plasma.

Keywords
Atmospheric plasma jet
Etching
Biomolecules