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## Microwave-Driven Micro Plasma Jets

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Atmospheric pressure plasma sources become more and more important in industrial applications. Small micro plasma jets can be used for selective treatment of complex three dimensional surfaces since their plasma can penetrate even into narrow capillaries. Applications are for example the increase of the adhesion of various liquids, deposition of films, layers, and coatings, or cleaning, decontamination, and sterilisation purposes. A very recent but also promising application of cold plasma jets is the plasma medicine.

The presented work includes the development of microwave-generated micro plasma jets, the characterisation of the plasma, and several selected applications. First the development of micro plasma jets which are based on coaxial  $\lambda/4$ -resonators will be presented. To attain a better understanding of the micro plasma jets and to provide ignition of the plasma without any additional igniters the electric field distribution inside the resonator as well as the coupling from the microwave generator to the resonator were simulated and analysed by using CST Microwave Studio. The characterisation of the plasma was carried out by optical emission spectroscopy. Active species were identified and their appearance along the plasma flame was analysed. The gas temperature was measured by investigating molecule band systems such as the  $A^2\Sigma^+-X^2\Pi_v$ -transition of the free OH-radical while the electron density was determined from the Stark broadening of the Balmer  $H_\beta$ -line. As application in the field of surface treatment the activation of polycarbonate will be presented. Furthermore, first results of the sterilisation effect of the plasma on with bacillus athrophaeus contaminated cellulose test stripes will be presented.

### Keywords

plasma source  
plasma jet  
atmospheric  
microwave  
optical emission spectroscopy