Calorimetric measurements on an atmospheric pressure plasma jet

Thorben Kewitz\textsuperscript{1}, Christoph Regula\textsuperscript{2}, Jörg Ihde\textsuperscript{2}, Holger Kersten\textsuperscript{1}

\textsuperscript{1}Group Plasma Technology, Kiel University, Kiel, Germany \textsuperscript{2}Fraunhofer-Institute for Manufacturing Technology and Advanced Materials IFAM, Bremen, Germany

kewitz@physik.uni-kiel.de

Atmospheric pressure plasma (APP) jets are used for many applications, including cleaning, activation and thin film deposition \cite{1, 2}. Compared to low pressure plasmas they are often preferred due to several advantages. APP-jets can be easily integrated in process lines due to lower space requirements, lower investment costs and handling times can be reduced. The main advantage of the APP-jet technique is the appropriate local treatment of substrates e.g. for bond lines or single elements. For applications where temperature sensitive materials are involved a detailed knowledge about the thermal load is needed to prevent material deterioration. In order to predict substrate damage caused by thermal load the energy flux density has to be measured, which is done here with a calorimetric probe \cite{3}.

A parameter study was performed on a commercially available atmospheric pressure plasma jet \cite{4} with a specifically designed calorimetric probe. Since the energy density and gas flow generated by this plasma jet are high, the probe has to withstand high mechanical and thermal load. Consequently, the design was adapted to these conditions, using a thicker probe and materials which are able to resist higher temperatures. The probe was embedded in a larger substrate in order to embrace the large treatment area of the APP-jet and to include the effects of the gas and heat flow without critical edge effects.

The results show the dependences of the energy flux density on different process parameters. Those results lead to a better understanding of the plasma jet and the interaction between the plasma jet and the substrate surface. Finally, they allow a precise adjustment of the treatment parameters for a given substrate material.

\begin{thebibliography}{9}
\bibitem{4} http://www.plasmatreat.de/
\end{thebibliography}

**Keywords**

atmospheric pressure plasma

calorimetric probe