THREE-DIMENSIONAL TOMOGRAPHIC RECONSTRUCTION OF THE ELECTRIC CURRENT DENSITY DISTRIBUTION WITHIN A TRANSFERRED PLASMA ARC*

B. Bachmann, J.-L. Marques, J. Schein and M. Richter
Institute for Plasma Technology and Mathematics, University of the Federal Armed Forces Munich, Munich, Germany

Modern applied plasma technologies like welding and plasma cutting are based on a reproducible application of transferred electric arcs at atmospheric pressures. Such arcs are nevertheless prone to instabilities, the control of which requires better understanding of the interdependence between the arc and several operating parameters like current, gas flow and anode temperature. This object can only be achieved if detailed diagnostic techniques are available, which preferable do not modify the arc to be investigated.
In this work a contactless diagnostic tool is presented to characterize the spatial structure of the plasma arc. Based on an original approach, the distribution of the magnetic field components measured by means of Hall sensors placed over a fine mesh of locations around the plasma arc is used to tomographically reconstruct the spatial distribution of the electric current density within the arc. The principle of operation, the numerical algorithm and its sensitivity to a superimposed random noise are discussed, showing the potential for identifying spatial inhomogeneities inside the transferred arc. Subsequently, preliminary experimental results for a typical arc as used in welding are presented.

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