TRANSPORT PHENOMENA IN AN ELECTROCHEMICAL ROTATING CYLINDER REACTOR

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Electrochemical processes are at the heart of a wide variety of both basic and advanced industrial activities. In many industrial electrochemical techniques the electrode moves with respect to the solution. These systems are called *hydrodynamic electrochemical processes*. In these processes generally hydrodynamical and electrochemical coupling are implied, because the electrochemical phenomenon is *convective-transport*-dependent. In order to obtain the mass and charge transfer from the solution to the surface of the electrodes the flow field characterization is therefore essential.

The objective of the present project, that is related to MuTEch (supported by IWT), is the preliminary characterization of the complex flow field that takes place in an electrochemical rotating cylinder reactor (short aspect ratio G = 1.7 and wide gap ? = 0.16). For this purpose an experimental, numerical and a theoretical approach is followed. The experimental characterization is performed using time-resolved Particle Image Velocimetry (PIV), a non-intrusive and laser-based experimental technique. Special attention is paid to the image processing and possible optical problems. The investigation is performed for different flow conditions, from moderate (1700) to high (13600)
Reynolds number.

The experimental results have been compared to the velocity profiles obtained using Fluent and DNS simulations. The former have been performed before starting with the measurements, while the latter were provided by J.F. Thomas (DC 05-06).

The theoretical part of this study is to provide new analytical models based on the solution of the momentum boundary layer equation and of the equations for mass and charge transport. The analytical velocity profile agrees well with the experimental data.

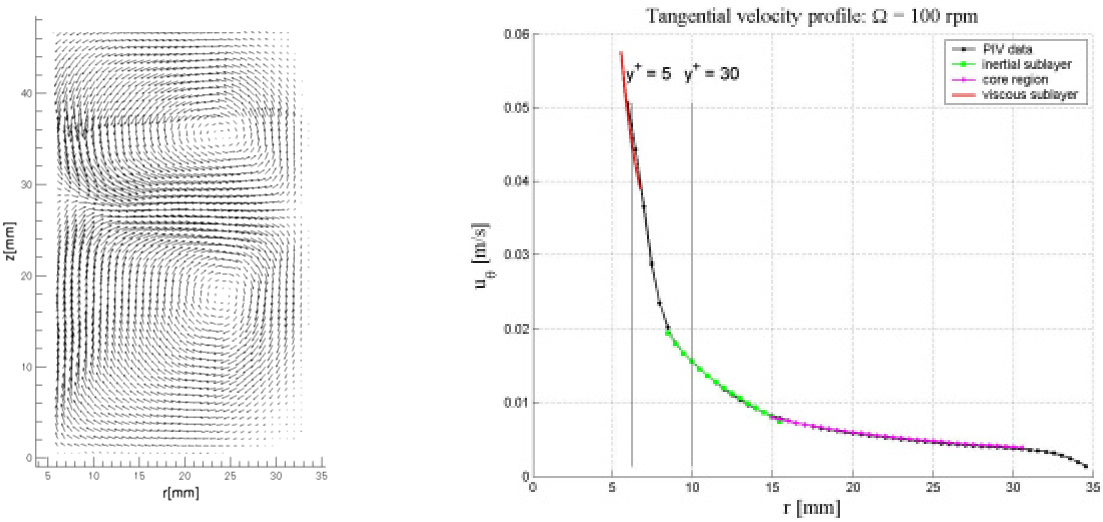

Figure 1: Average velocity vectors obtained with PIV at Re = 1700 (left).
Average tangential velocity profile: preliminary models validation (right).