JET WIPING AT SMALL STAND-OFF DISTANCES

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Jet wiping is a coating process where a liquid layer, which is dragged by an upward moving strip, is washed by an impinging air jet to decrease its thickness to a desired value. The final liquid film thickness h_f depends on the strip velocity U, the jet nozzle pressure P_N, the nozzle-strip distance z and the nozzle slot d.

The jet wiping process is applied in the galvanization industry where a very small coating thickness is sought. This can be achieved by working at high P_N or by wiping at small z. The objective of this project is the modelling and validation of jet wiping at small stand-off distances (z/d<8). A numerical and experimental approach is adopted.

The Knife Model developed at VKI allows the fast computation of the final coating thickness h_f if the jet maximum pressure gradient ∇P_{max} and the maximum shear stress τ_{max} are specified. Until now few studies of impinging jets at z/d < 8 have been done. Moreover, their results disagree. Therefore, a new correlation for ∇P_{max} and τ_{max} has to be established.

Numerical simulations of an impinging jet were performed with FLUENT code for small z/d values (=2,4,6,8), and wall pressure measurements were conducted in a new set-up. Numerical and experimental values of ∇P_{max} are found to be in agreement and have led to a new correlation; only numerical values of τ_{max} have been correlated to the wiping parameters. These correlations have been implemented within the Knife Model. Then, the predicted final thickness h_f have been compared to experimental data obtained in the ESSOR facility (simulation of a galvanization line with water as a working fluid). Good agreement has been found (Figure 1). The study shows that as long as the normalised standoff distance z/d remains smaller than 8, the final coating thickness is more or less constant when all the other operating parameters are fixed.

Future works will be addressed to experimental measurements of τ_{max} and further numerical simulation of impinging jet with emphasis given to the effect of the internal geometry of the nozzle and the presence of the liquid film.

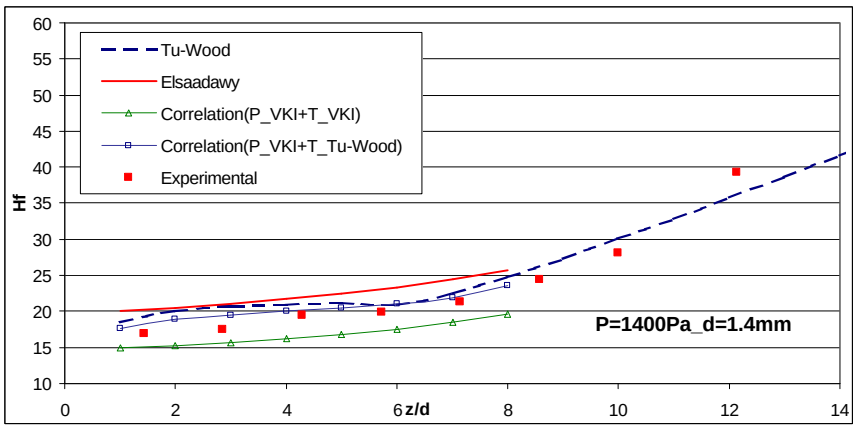

Figure 1: Final liquid film thickness versus z/d for correlations found in literature, new correlation and experimental data