

Numerical and experimental study of spray coating using air-assisted high pressure atomizers

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Abstract

Spray coating processes are characterized by their relatively large paint wastage and high energy consumption, especially in car industry. The unavoidable overspray, caused by poor transfer efficiency, has to be removed quickly from the paint booth, in order to preserve the painting quality on the subject surface. The therefore needed conditioned air stream results in intensive energy requirement for the disposal of the overspray. Against the background of increasing demands on energy-efficient painting processes, a research project has been launched focusing on increasing the efficiency of atomizers in painting processes. This paper summarizes some results of the current state of the research.

The air supported high pressure atomizer, also known as AirCoat or AirMix, is basically an airless atomizer with additional air flow for improved atomization and homogenization of the spray cone. Compared to the well-known air spray painting, the spray transfer efficiency of airless and air-assisted atomizers is relatively high, corresponding to a lower overspray. Therefore, air-assist atomizing is used in the present experimental and numerical investigations. Fraunhofer diffraction and Laser-Doppler Anemometry were used to measure droplet size distributions and the integral droplet velocity in spray cone. Furthermore, the film thickness distribution on a flat plat was also measured. A commercial CFD code (ANSYS-FLUENT) was used in the numerical studies. Influences of the additional air flow in air-assist gun on the atomization process, the film thickness distribution and the transfer efficiency were studied. A typical result is shown in Fig. 1-2. The experimental and simulation results delivered the necessary information for understanding the painting process using air-assisted guns and for improving the performance of the atomizer.

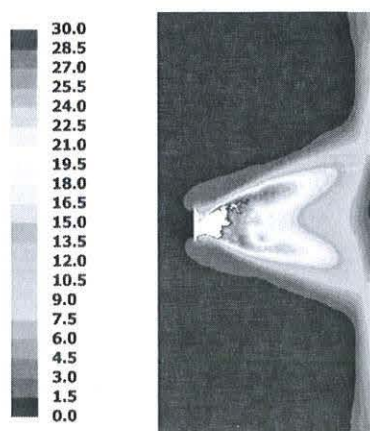


Fig. 1: Air velocity contours (m/s) in spray cone (air-assist system)

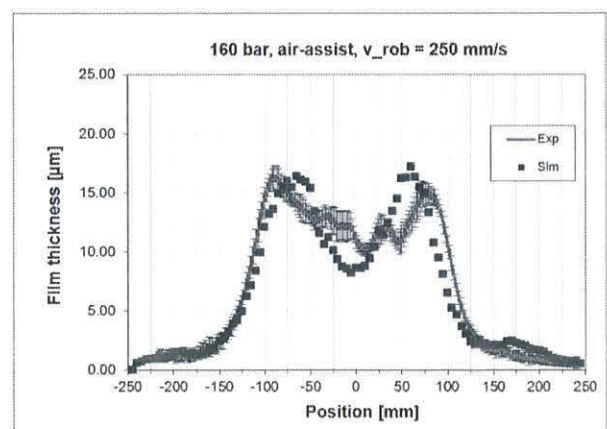


Fig. 2: Comparison of film thickness distributions (air-assist system)

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