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Microscopic analysis and simulation of check-mark stain on the galvanized steel strip HONGYUN SO, HYUN GI YOON, MYUNG KYOON CHUNG, Korea Advanced Institute of Science and Technology (KAIST) — When galvanized steel strip is produced through a continuous hot-dip galvanizing process, the thickness of adhered zinc film is controlled by plane impinging air gas jet referred to as “air-knife system”. In such a gas-jet wiping process, stain of check-mark or sag line shape frequently appears. The check-mark defect is caused by non-uniform zinc coating and the oblique patterns such as “W”, “V” or “X” on the coated surface. The present paper presents a cause and analysis of the check-mark formation and a numerical simulation of sag lines by using the numerical data produced by Large Eddy Simulation (LES) of the three-dimensional compressible turbulent flow field around the air-knife system. It was found that there is alternating plane-wise vortices near the impinging stagnation region and such alternating vortices move almost periodically to the right and to the left sides on the stagnation line due to the jet flow instability. Meanwhile, in order to simulate the check-mark formation, a novel perturbation model has been developed to predict the variation of coating thickness along the transverse direction. Finally, the three-dimensional zinc coating surface was obtained by the present perturbation model. It was found that the sag line formation is determined by the combination of the instantaneous coating thickness distribution along the transverse direction near the stagnation line and the feed speed of the steel strip.

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