

Weerachai Chaiworapuek 2014: Investigation of 3D Structure of Turbulent Spot using Liquid Crystals. Doctor of Engineering (Mechanical Engineering), Major Field: Mechanical Engineering, Department of Mechanical Engineering. Thesis Advisor: Associate Professor Chawalit Kittichaikarn, D.Phil. 177 pages.

This study focuses on a flow visualization of an artificially generated turbulent spot, bypassed under boundary layer transition over flat plate. The experiment was carried out in a low free stream turbulence water tunnel using three visualization techniques, consisting of coating liquid crystals for temperature measurement on surface, slurry liquid crystal for temperature detection in fluid, and milk solution to visualize the structure of turbulent spot. From these techniques, a full mechanism in growth development and heat transfer was well described. Not only the spot celerities of laminar-turbulent interface, but also spreading half angle were informed and compared to those reported by the other researchers. The contour of temperature on the footprint and within the fluid structure as well as heat transfer coefficient, and heat flux were provided instantaneously. The representative structure of turbulent spot was proposed to reveal the average characteristics of turbulent spot. Moreover, the turbulent spot manner under the influence of various adverse pressure gradients was also observed. Therefore, these qualitative and quantitative results may lead to the better understanding in growth and heat transfer mechanism of the turbulent spot and they are helpful for the development of an accurately predictive formula for full evolution of the bypassed transition flow.

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Thesis Advisor's signature

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