Optimized Jet Impingement Heat Transfer with Reduced Splatter

Sucharitha Rajendran (PI), Raj M Manglik, Milind A. Jog

Department of Mechanical and Materials Engineering
University of Cincinnati

Understanding and being able to manipulate the drop distribution emerging from an impinging jet splattering on a heated surface finds many practical applications. When cutting fluid hits the heated site of a surface being machined, the drops sprayed would be subjected to sudden evaporation. The resultant mist could be inhaled by the workers in the vicinity and is harmful. The goal of the proposed research is to investigate the formation of droplets and aim at creating a model that accounts for fluid properties, nozzle geometry, angle of incidence and the ambient conditions. This will help minimize the splatter during jet impingement process and provide an optimum working condition without compromising on providing cooling at the machining site. The model developed can be of use in other industries such as fertilizer treatment, spray coating and in annealing of metals, where, if the drop sizes are too small, probability of spray and contact is more. An experimental set-up consisting of jet impinging on a surface maintained at a constant heat flux will be used. The flow rate of the jet can be controlled using a pressure regulator and flow control valves. Infra Red camera placed at an appropriate location near the heated surface will help gauge the effectiveness of cooling by jet impingement. A high speed digital camera will be used to capture the drop distribution and splatter. Numerical modeling of the same phenomena will be done on OpenFOAM. The experimental results will aid in perfecting the numerical model which will be used to study the influence of ambient conditions. This will then enable us to modify the test parameters and see its effect on drop distribution and cooling efficiency. The model thus developed, can then be integrated with the research on drop spreading and phase change on impact with a heated surface done in our laboratory. A consolidation of these two, will then help us see the generation and spreading of mist on jet impingement. The model thus developed can then be used to optimize the effects of jet impingement based on the application which could range from pesticide control to drug delivery. Finally, we hope to provide a means to reduce splatter and contact on the operators present.

Corresponding author: *Ms. Sucharitha Rajendran at rajendsa@mail.uc.edu*

University of Cincinnati
14th Annual
Pilot Research Project Symposium
October 10-11, 2013

Main Menu

Hosted by: The University of Cincinnati Education and Research Center
Supported by: The National Institute for Occupational Safety and Health.
(NIOSH) Grant #: T42/OH008432-08

- **Pilot Research Project Overview**
- **Welcome and Opening Remarks**
- **Keynote Speakers**
- **Podium Presentations**
- **Poster Presentations**
- **Video Montage of the 14th Annual PRP Symposium**
- **Participating Universities**
- **Steering Committee Members**
- **Acknowledgements**
- **Problems Viewing the Videos**

- **PRP Website**

Produced by Kurt Roberts Department of Environmental Health