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Jet and spray quenching near-industrial conditions: results and next steps

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Experimentation under near-industrial conditions presents significant challenges due to the typically harsh temperatures, pressures, and environments involved. These conditions often necessitate the use of larger thermocouples, which dampen fast transients and can lead to a loss of local resolution. While laboratory-scale data can offer valuable insights into the local and temporal aspects of the quenching process, the connection between small- and large-scale processes still requires further investigation. In this talk, I present results from near-industrial quenching experiments for metallurgical applications — specifically, single-jet cooling of a large nickel plate and the use of a 120-jet water ring to cool a large steel bar. By pseudo-analytically solving the corresponding inverse heat conduction problem, local heat fluxes were estimated and used to develop a correlation for the heat transfer coefficient. Additionally, a temperature correction method was introduced and shown to be crucial for achieving accurate heat flux estimations. Finally, I will outline the next steps toward developing precise droplet impact heat transfer models for future spray cooling experiments.

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