

Synopsis Seminar

Seminar Title	: Enhancement of Spray Cooling at Very High Temperature by Using Various Novel Techniques
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Venue	: Department Seminar Hall
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Abstract	: This research investigates the heat transfer performance of spray cooling on a steel plate under static and dynamic conditions with different orientations, including downward, upward, and both sides. Various coolants such as NaCl, benzene, ethanol, beer, and CNT added water were utilised at different concentrations. Optimal coolant concentrations for enhanced heat transfer were identified as 0.5 M NaCl, 1600 ppm benzene, 500 ppm ethanol, 10% beer, and CNT nanoparticles. Heat transfer characteristics were primarily observed in the transition and nucleate boiling regimes. For downward cooling, beer achieved the highest heat flux of 2.316 MW/m², which is 45.25% higher than pure water. In upward cooling, beer noticed a maximum CHF of 2.569 MW/m², surpassing water by 49.2%. Upward cooling consistently outperformed downward cooling across all coolants. In static conditions, both side spray cooling with CNT achieved a heat flux of 2.905 MW/m², marking a 13.07% improvement over upward beer spray cooling and a 25% increase compared to downward beer spray cooling. Under dynamic conditions, upward cooling with water showed a 32.39% improvement, and the highest CHF of 2.901 MW/m² was observed with beer. Correlation analysis revealed that the design expert model produced the lowest error margin. Microstructural analysis via SEM and XRD confirmed the formation of martensite, enhancing the mechanical properties of the steel. Hardness and tensile strength improved by at least 1.4 times compared to as received steel, with further enhancements observed through optimised nozzle orientation and cooling methods. Corrosion analysis indicated that NaCl resulted in the highest corrosion rates, while CNT added water exhibited the lowest. Pure water showed moderate corrosion rates. The coolant composition increased with Fe content and TDS levels, requires treatment before reuse or disposal. Overall, beer added water established superior cooling performance under both static and dynamic conditions. CNT added water is recommended for both side spray cooling due to its high heat transfer rate and minimal environmental impact, with ethanol added water also being a sustainable option. Keywords: Boiling;