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Numerical Prediction of Heat Transfer for Supercritical Carbon Dioxide in Horizontal Circular Tubes

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Due to their high specific heat, low viscosity, and good diffusivity, supercritical fluids have the potential to be ideal coolants. In addition, the supercritical heat transfer properties are shown to result in up to 45% efficiency in nuclear power generation, which operates nearly at 550℃. However, understanding the heat transfer for fluids under supercritical conditions has been a challenge. In this regard, a wide range of experiments with different parameters has been performed to understand the peculiar heat transfer characteristics. The generated experimental database could serve as a reference to assess the prediction capabilities of the Reynolds-Averaged Navier-Stokes (RANS) based computational fluid dynamics (CFD) approach under supercritical conditions. RANS is the most widely used modeling approach and has been an industrial workhorse for decades. This work aims to study the heat transfer characteristics of supercritical Carbon Dioxide (sCO2) in horizontal tubes using different RANS models. Various flow conditions are modeled to study the impact on the heat transfer coefficient. A large-temperature variation is also expected in some conditions due to stratification. In such cases, the impact of buoyancy on the heat transfer coefficient is also explored. The prediction capabilities of selected RANS models will be assessed against the experimental reference data and will be presented in a full-length article.

Speaker Bio

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