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Design and fabrication of key components in high temperature concentrated solar power (CSP) plants



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ABSTRACT:

The increasing difficulties brought by global climate change highlight the critical need to achieve carbon neutrality. The United States is actively working towards this goal, stressing the immediate necessity for creative and sustainable solutions to address climate change impacts. Concentrated Solar Power (CSP) has emerged as a highly beneficial renewable energy source, notable for its scalability in power production and its capacity to store excess thermal energy. Amongst all CSP technologies, concentrated solar power tower (CSPT) is preferred due to its ability to reach higher temperatures ($>700^{\circ}\text{C}$) which correlate with higher thermal efficiencies ($>50\%$). CSPTs operate by being surrounded by heliostats that redirect the sun's solar flux onto a solar receiver and heat a transfer fluid (HTF). The HTF can be molten salt for temperature range from 500°C to 700°C , and silica sand ranging from 700°C to 1000°C . Therefore, there is strong research needs to tackle the technical difficulties at high temperatures for enhanced thermal performance of key components, such as thermal energy storage unit, solar receivers, and cooling system. In this talk, we will discuss the design and fabrication of key components in a typical CSPT system, both molten salt thermal storage and particle thermal storage systems will be discussed.

BIOGRAPHY:

Dr. Ben Xu is an Assistant Professor, Presidential Frontier Faculty Fellow in the Department of Mechanical Engineering at University of Houston (UH) since January 2023. He obtained his Ph.D. from University of Arizona in 2015. Prior to joining UH, Dr. Xu worked as Assistant Professor of Mechanical Engineering in Mississippi State University (MSU) and University of Texas Rio Grande Valley (UTRGV), Postdoctoral Research Fellow at Drexel University. Dr. Xu was selected as Department of Defense MEEP Faculty Fellow in summer 2020. He also received the most cited paper awards in Applied Energy and ChemBioEng. Currently, he is serving as the general chair for ASME Energy Sustainability conference, and he was also the chair of Renewable Energy and Energy Conversion committee in Advanced Energy System Division at ASME from 2020 to 2022. Dr. Xu is the editorial board member for Advances in Manufacturing. Dr. Xu has been PI and Co-PI at UH, MSU and UTRGV on multiple projects from US Department of Energy, Department of Defense, Department of Agriculture, National Science Foundation, and NASA, and he has attracted total research funding more than \$1 million. He has more than 80 peer reviewed journal publications and conference papers, and his total citation on Google Scholar is more than 2400.