

Pre-Conference Tutorial Sessions

Fundamental Review of sCO₂ Power Cycles – 12:30 – 2:00

The recent interest to use supercritical CO₂ (sCO₂) in power cycle applications over the past decade has resulted in a large amount of literature that focuses on specific areas related to sCO₂ power cycles in great detail. Such focus areas are demonstration test facilities, heat exchangers, turbomachinery, materials, and fluid properties of CO₂ and CO₂ mixtures, to name a few. As work related to sCO₂ power cycles continues, more technical depth will be emphasized in each focus area, whereas those unfamiliar with the topic are left to undertake the large task of understanding fundamentals on their own.

This tutorial provides an introduction to using sCO₂ in power cycle applications, aimed at those who are unfamiliar, or only somewhat familiar with the topic. The tutorial includes a brief review of CO₂ and its current industrial uses, a primer on thermodynamic power cycles, an overview of supercritical CO₂ power cycle applications and machinery design considerations, and a summary of some of the current research and future trends.

Turbo Machinery Design for Supercritical CO₂ Applications – 2:00 – 3:30

sCO₂ Brayton cycles offer advantages of improved thermal efficiency over traditional Rankine cycles. However, in order to operate supercritical, the working pressures are quite high compared to traditional gas turbines with fluid densities exceeding water. The high energy content of the fluid results in impressively high power densities for this class of machinery. This compact size has significant advantages where space is limited, such as, concentrating solar power towers and naval propulsion. With high power density comes many aerodynamic and mechanical challenges including rotordynamics, blade dynamics, blade loading, power transmission, thermal management, pressure containment, seals and bearings. This tutorial will explore each of these areas and provide example machines that have been developed or are currently under development.

Materials for Supercritical CO₂ Applications – 3:30 – 5:00

The tutorial addresses requirements for and selection of materials to withstand the high-temperature, and high-pressure conditions applicable to components performing in sCO₂ environments. The tutorial is an essential introduction for designers, materials scientists and engineers in the sCO₂ application space.

Heat Exchangers for Supercritical CO₂ Power Cycle Applications – 5:00 – 6:30

This tutorial provides an introduction to heat exchangers used in supercritical CO₂ (sCO₂) applications. A brief overview of sCO₂ is followed by the types of heat exchangers currently in use for sCO₂ power cycles. Then a system-level overview of heat exchangers for sCO₂ applications is given. Finally, design topics are discussed for mechanical, hydraulic, and heat transfer considerations.

