

Overcoming the Divide: A Comprehensive Assessment of Oxy-Coal Combustion Simulation at Semi-Industrial Level

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Introduction

In the landscape of contemporary energy solutions, the quest for cleaner and more sustainable alternatives has brought oxy-coal combustion to the forefront. This innovative technology, characterized by the use of oxygen instead of air in the combustion process, stands as a promising avenue for achieving both energy efficiency and environmental responsibility. Particularly significant when integrated with carbon capture and storage (CCS) initiatives, oxy-coal combustion has the potential to revolutionize how we generate power while mitigating the impact on climate change.

This article embarks on a comprehensive exploration of oxy-coal combustion modeling, delving into the intricacies of its application at a semi-industrial scale. The theoretical foundations of oxy-coal combustion are vast, encompassing the physics of oxygen and recycled flue gas injection, flame dynamics, heat transfer, and the formation of pollutants [2]. Yet, the translation of these theoretical frameworks into practical applications requires rigorous evaluation, especially when dealing with the complexities of semi-industrial settings.

Our endeavor involves a meticulous scrutiny of computational models against empirical data obtained from a semi-industrial oxy-coal combustion facility. This evaluation aims to bridge the gap between theory and practice, offering a critical assessment of the accuracy and reliability of these models in predicting the dynamics of combustion processes. By dissecting the interplay of oxygen injection, flame characteristics, and pollutant formation within semi-industrial oxy-coal environments, we seek to unravel crucial insights that can inform not only the refinement of theoretical frameworks but also the optimization of practical applications [3].

As oxy-coal combustion continues to evolve as a pivotal technology in the global energy landscape, understanding its behavior at a semi-industrial scale becomes imperative. The knowledge gained from this evaluation has the potential not only to enhance our theoretical understanding but also to guide the optimization of oxy-coal combustion systems, contributing to a more sustainable and efficient future in energy generation [4].

Method

1. Extensive literature review

Commence the research with an exhaustive literature review encompassing oxy-coal combustion modeling. Explore theoretical frameworks, computational methodologies, and empirical studies to establish a robust foundation for the evaluation.

2. Selection criteria for semi-industrial facility

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PROCESSES

6. Advanced computational modeling

Utilize state-of-the-art computational models to simulate oxy-coal combustion processes. Implement theoretical frameworks that consider oxygen injection, flame dynamics, heat transfer, and pollutant formation. Tailor these models to account for the specific characteristics

semi-industrial oxy-coal combustion.

9. Comparisons with previous studies

- **Alignment with literature:**