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JES
JOURNAL OF
ENVIRONMENTAL
SCIENCES
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Review

A review of low-carbon technologies and projects for the global cement industry

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ARTICLE INFO

Article history:

Received 24 October 2022

Revised 11 January 2023

Accepted 17 January 2023

Available online 2 February 2023

Keywords:

Cement industry

CO₂ emissions

Low carbon development

Projects

Carbon capture, utilization, and storage

ABSTRACT

Carbon dioxide (CO₂) emissions from the cement industry account for 26% of the total industrial emissions, and the need to develop low-carbon techniques within the cement industry is extremely urgent. Low-carbon projects and technologies for the cement industry in different regions and countries have been thoroughly reviewed in this manuscript, and the low-carbon development concept for each county has been analyzed. For developing countries such as China and India, energy saving and efficiency enhancement are currently the key points, while for developed countries and regions such as Europe, more efforts have been focused on carbon capture, utilization, and storage (CCUS). Global CCUS projects have been previously conducted, and the majority of CCUS projects are currently performed in Europe where major projects such as the CEMCAP, CLEANKER, and IEILAC projects represent the latest research progress in cement production technologies and low-carbon technologies for the global cement industry. The development of low-carbon cement technologies has changed from focusing on the end point to instead focusing on the source and process through the exploration of hydrogen and solar energies, and more disruptive and original technologies are expected to be developed, particularly in the cement industry in China.

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Introduction

As a major greenhouse gas, large emissions of CO₂ contribute to the global greenhouse effect. In 2019, CO₂ emissions from

cement industry reached 2.4 Gt, accounting for 26% of the total industrial emissions (IEA, 2020a), and the low-carbon development for the cement industry is extremely urgent. Over 90% of countries and regions world-wide produce cement, and the global production of cement reached 4.1 Gt in 2019. Fig. 1

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