Mechanical Engineering Thesis Defense

Making the Manufacturing of Cement Zero Net Carbon via the utilization of the Brayton Cycle

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Abstract

According to Our World in Data, the industry sector contributes approximately 5.2 percent of the world's greenhouse gas emissions for the year 2016. Of that percentage, the cement industry contributes approximately 3 percent, thus accounting for more than 57 percent of all greenhouse gas emissions within the industry sector. Industrial-scale heating that is powered by renewable energy sources has the potential to combat this issue. The goal of this paper is to analyze and model the Reverse Brayton Cycle to be used as a heat pump in a novel cement production system. The Simple Reverse Brayton Cycle and its potential concerning performance indicators such as coefficient of performance and scalability are determined. A Regenerative Brayton cycle is modeled in MATLAB® programming in order to be optimized and compared to conventional processes that require higher temperatures. Traditional manufacturing methods are discussed. Furthermore, possible methods of improvement are explored to view its effect on performance and temperatures between stages within the cycle.

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