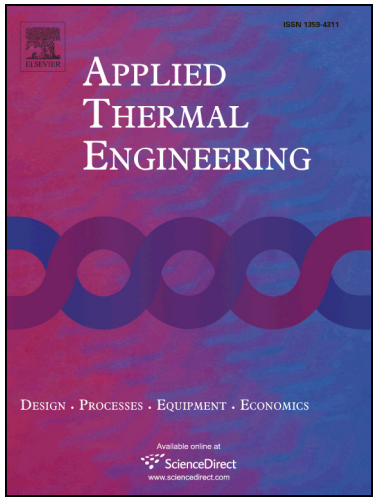

Research Paper

Study on nozzle design for combustion of solid materials with low melting points

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Study on nozzle design for combustion of solid materials with low melting points

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Highlights

- Nozzle design for combustion of materials with low melting points was studied.
- Nozzle air flow rate has a strong influence on nozzle temperature.
- Nozzle air flow at 40 m^3/h shows best results with nozzle 2.

Abstract

Waste disposal is a core issue worldwide. Different researches are being carried out in order to handle waste materials, generated in industrial production and application processes, e.g. paint residue from metal coating in the automobile industry. Often waste is disposed in landfills at substantial economic and environmental cost. Combustion is another way to get rid of possibly hazardous waste. Pulverized fuel combustion is one of the latest combustion technologies. However, pulverized fuel combustion faces severe problems if the waste (fuel) contains components with low melting point. Having a low melting point, it gets difficult to manage and convey the pulverized material to the hot combustion chamber. The melting of fuel causes clogging in the fuel transport nozzle used to convey the material into the combustion chamber. In this work, a new technology for combustion of materials with low melting points is proposed, focusing on apparatus and nozzle design to prevent clogging. For this purpose, different nozzle designs were evaluated by multi-phase CFD simulations. Two sets of nozzle air flow rates were used in four nozzles. Effect of different flow rates and fuel particle size on combustion temperatures are also discussed. It was noted that nozzle air flow rate has a strong influence on the temperature distributions. Small fuel particle sizes result in wider combustion zones while larger particles give longer combustion zones. The results come up with optimized nozzle design and nozzle air flow for transportation of pulverized material with low melting point.

Keywords: Pulverized fuel, combustion, melting point, nozzle, CFD, particle size