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Carbon Dioxide Use in Beneficiation of Landfilled Coal Ash for Hazardous Waste Immobilization

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Abstract

Landfilled coal fly ash and supplementary minerals were processed into a hydraulic cement binder via input of mechanical energy at ambient temperature in the presence of carbon dioxide (CO₂) (considered as a gaseous raw material). An experimental program was conducted with the purpose of optimizing the raw materials formulation for achieving a desired balance of cement chemistry for CO₂ capture, compressive strength and heavy metals immobilization qualities of the cement hydration products. The optimum formulation was found to complement high levels of CO₂ capture with desired material properties offered by the hydration products. Insight into the structure of hydration products was gained by evaluating their chemical bond structure and thermogravimetry attributes.

Keywords: hydraulic cement; alkali-activated aluminosilicate cements; carbon dioxide capture; heavy metals immobilization; landfilled coal fly ash; waste management

Introduction

Climate change and waste management are among the environmental problems threatening sustainable development (Smith, Brown et al. 2001). Cement industry has played a vital role in development of in-

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