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Abstract

Leaching Kinetics of Ironmaking Blast Furnace Slag as a Source of Calcium for CO_2 Sequestration †

Makhitha Masipa [1], Itumeleng Kohitlhetse [1,*], Hilary Rutto [1], Kentse Motsetse [1] and Malibongwe S. Manono [2]

[1] Clean Technology and Applied Materials Research Group, Department of Chemical and Metallurgical Engineering, Vaal University of Technology, Private Bag X021, Vanderbijlpark 1911, South Africa; makhithac1989x@gmail.com (M.M.); hilaryr@vut.ac.za (H.R.); kentset@vut.ac.za (K.M.)

[2] Centre for Minerals Research, Department of Chemical Engineering, University of Cape Town, Private Bag X3, Rondebosch 7701, South Africa; malibongwe.manono@uct.ac.za

* Correspondence: itumelengk@vut.ac.za

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Abstract: An ironmaking blast furnace slag was prepared and dissolved in lixiviant solutions of known concentrations for the leaching of calcium. A portable laboratory orbital shaking incubator was used for the leaching experiments. In addition, XRF and AAS were utilised for the sample characterization of solid residues and leach liquor, respectively. This study demonstrated that increasing the concentration of the solvent enhances the efficiency of calcium extraction; however, it also causes the leaching of other elements, such as magnesium, which can impede the carbonation stage. The research also revealed that the extraction of calcium from the largest particles is constrained by mass transfer and the accessibility of calcium from the particle. The authors hypothesize that the reaction products build up and hinder the reaction on the surface layer of the particles. However, with the smallest particle size fraction, more calcium can be extracted before the surface is obstructed, thus ensuring maximum extraction efficiency. Based on the activation energy value of 70.51 kJ/mol, it is less likely that the leaching of blast furnace slag in ammonium nitrate is a product-layer-diffusion-controlled process, as the activation energy for this type of process is usually below 20 kJ/mol. Instead, the higher activation energy suggests that the leaching process may be controlled by surface chemical reactions or a mixed mechanism. However, more detailed analysis and experimental data would be required to confirm the reaction mechanism.

Keywords: CO_2 sequestration; ironmaking blast furnace slag; leaching reaction; shrinking core model

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