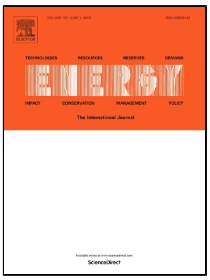
Accepted Manuscript



Multistep sequestration and storage of CO_2 to form valuable products using forsterite

Waseem Raza, Nadeem Raza, Henry Agbe, R.V. Kumar, Ki-Hyun Kim, Jianhua Yang

PII:	S0360-5442(18)30897-1
DOI:	10.1016/j.energy.2018.05.077
Reference:	EGY 12912
To appear in:	*Energy*
Received Date:	13 March 2018
Revised Date:	07 May 2018
Accepted Date:	10 May 2018

Please cite this article as: Waseem Raza, Nadeem Raza, Henry Agbe, R.V. Kumar, Ki-Hyun Kim, Jianhua Yang, Multistep sequestration and storage of CO_2 to form valuable products using forsterite, *Energy* (2018), doi: 10.1016/j.energy.2018.05.077

Multistep sequestration and storage of CO_2 to form valuable products using forsterite

Waseem Raza[a1], Nadeem Raza[b,c1], Henry Agbe[b], R.V. Kumar[b], Ki-Hyun Kim[d*], Jianhua Yang[a]

[a] *Institute of Adsorption and Inorganic Membrane, School of Chemical Engineering Dalian University of Technology Dalian, 116012, P. R. China;* [b]*Department of Material Science & Metallurgy, University of Cambridge, United Kingdom;* [c]*Govt. Emerson College, affiliated with Bahauddin Zakariya University, Multan 60800, Pakistan;* [d] *Department of Civil and Environmental Engineering, Hanyang University, 222 Wangsimni-Ro, Seoul, 04763, Republic of Korea*

Abstract

The potential use of mineralogical carbonation is greatly acknowledged not only in reducing CO_2 emissions through carbon capture and storage (CCS) but also in producing industrially viable products. The direct carbonation of stable silicate minerals by supercritical CO_2 is unrealistic due to the low conversion efficiencies. The natural abundance of silicate minerals (e.g., olivine) is theoretically sufficient to fix the entire quantity of man-made CO_2 emissions, while carbonation of sorbents obtained from the dissolution of silicate rocks could proceed in a multistep (or continuous) process. In this work, the optimum experimental conditions for a multistep procedure of sequestration of minerals and conversion of CO_2 into valuable products were investigated using synthetic forsterite. In this research, magnesium sulfate obtained from the dissolution of forsterite in aqueous H_2SO_4 was successfully carbonated to produce valuable byproducts (e.g., silica and hydrates of magnesite) with an economical carbonation as a means of CO_2 mitigation. Hydromagnesite, while being commercially applied in various fields (e.g., fire retardation and catalysis), can be transformed to magnesite which is stable for millions of years.

Keywords: Fossil fuels; CO_2 sequestration; mineralogical carbonation; forsterite; hydromagnesite; lixiviants

Correspondence: kkim61@hanyang.ac.kr

[1]These authors are considered as co-first authors because they contributed equally to this work.