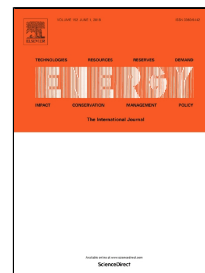


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Multistep sequestration and storage of CO<sub>2</sub> to form valuable products using forsterite



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**Multistep sequestration and storage of CO<sub>2</sub> to form valuable products using forsterite****Waseem Raza<sup>a1</sup>, Nadeem Raza<sup>b,c1</sup>, Henry Agbe<sup>b</sup>, R.V. Kumar<sup>b</sup>, Ki-Hyun Kim<sup>d\*</sup>, Jianhua Yang<sup>a</sup>**

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**Abstract**

The potential use of mineralogical carbonation is greatly acknowledged not only in reducing CO<sub>2</sub> emissions through carbon capture and storage (CCS) but also in producing industrially viable products. The direct carbonation of stable silicate minerals by supercritical CO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> into valuable products were investigated using synthetic forsterite. In this research, magnesium sulfate obtained from the dissolution of forsterite in aqueous H<sub>2</sub>SO<sub>4</sub> was successfully carbonated to produce valuable byproducts (e.g., silica and hydrates of magnesite) with an economical carbonation as a means of CO<sub>2</sub> 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<sub>2</sub> sequestration; mineralogical carbonation; forsterite; hydromagnesite; lixivants

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