

Unlocking the H₂ Potential in Saudi Arabia: Exploring Serpentinites as a Source for H₂ Production

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Abstract

The global transition to a low-carbon energy future has ignited interest in hydrogen as a clean and versatile energy carrier. Saudi Arabia contains vast tracts of mantle-dominated Neoproterozoic ophiolites overlain by a sedimentary cover in the east. Our research explores the untapped potential of Saudi Arabia's ophiolite serpentinites as a possible source of hydrogen generation through serpentinization and related processes. H₂ is derived from serpentinization, which primarily involves the hydration of minerals rich in iron and magnesium, (e.g., olivine), resulting in the formation of serpentine and H₂. We have conducted a comprehensive assessment of serpentinites in the Arabian Shield employing the Geographic Information System (GIS) to locate, Arabian ophiolites with the largest ultramafic segments. Ophiolites studied include Jabal Ess, Jabal Wask, Bi'r Tululah, and Jabal Tharwah. Subsequent to ophiolite identification, we delineated fractures and measured fracture density to provide insight into the potential of serpentinite fractures on the amount of hydrogen seepage and the rate of hydrogen production. The results of our quantitative fracture density analysis and their relation to the volume and rate of hydrogen production will be discussed. A complimentary H₂ anomaly survey will ground-truth the results of this study.

Keywords: serpentinite, hydrogen, serpentinization, Ultramafic rocks, Arabia, potential