

Natural Hydrogen Generation – A Comment from a Chemistry Perspective

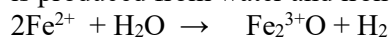
J. Lipkowski^{1,2}

¹Ningbo University of Technology, CEEC Institute, Ningbo, China

²Cardinal Stefan Wyszyński University In Warsaw, Faculty of Mathematical and Natural Sciences, Woycickiego 1/3, 01-938 Warszawa, Poland

*Corresponding Author email: Janusz.lipkowski@wp.pl

"Natural hydrogen", white or gold, was discovered on a massive scale in 1987 as the unexpected result of drilling for water [1]. In recent years, a rapidly growing interest in the exploitation of natural resources, and, first of all, in identifying possible sources of hydrogen naturally formed in the Earth's crust, has been observed. Needless to say, hydrogen is an evident and desirable source of energy. From a chemical standpoint, it is crucial to understand the possible reactions in the Earth's crust that may be the source of 'natural' hydrogen. So far, it is commonly accepted that hydrogen 'on the rocks' is produced from water and iron-containing minerals by reaction (schematically)



(so-called serpentinisation, e.g. transformation of olivine to serpentinite) alternatively, by radiolysis processes[1]. Some interesting chemistry also comes from the reaction of CO with H₂O at elevated temperatures and the possible sequestration of CO₂ by silicate materials. The present communication proposes another alternative in which silicon materials play a key role in hydrogen generation.

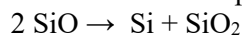
The concept

Astronomers claim silicon monoxide is the most abundant chemical form of silicon in the Universe[2,3]. In a recently published paper on solid condensation in protoplanetary systems, the importance of SiO is highlighted [2]. Terrestrial planets and small bodies in our Solar System were reportedly born through reactions involving gaseous SiO. Although no precise data on SiO content in the Earth's crust are available, it seems reasonable to assume that the originally abundant content (SiO) may be present in considerable quantities even now, although not evidenced by routine geoanalytical procedures [5].

We therefore propose an alternative chemical mechanism involving silicon and its simple oxides, leading to gaseous hydrogen. Silicon is the eighth, in terms of abundance, chemical element in the Universe. In the form of monoxide, SiO₂, it reacts with water, producing hydrogen.



SiO is the difficult product since. e.g, at elevated temperatures, it undergoes dismutation



It does not, however, eliminate reduction properties of the product since silicon itself can serve as a reducing agent, particularly efficient on the micro or nano scale, however, requiring alkaline media for the reaction



Conclusion

It seems likely that molecular hydrogen generated on Earth is produced by the reduction of water by silicon monoxide or by a mixture of silicon monoxide and elemental silicon. The amount of these materials in the Earth's crust may be substantial, and hence hydrogen generation may reach high, long-term efficiency.

References

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