

24th World Nano Conference

May 07-08, 2018 | Rome, Italy

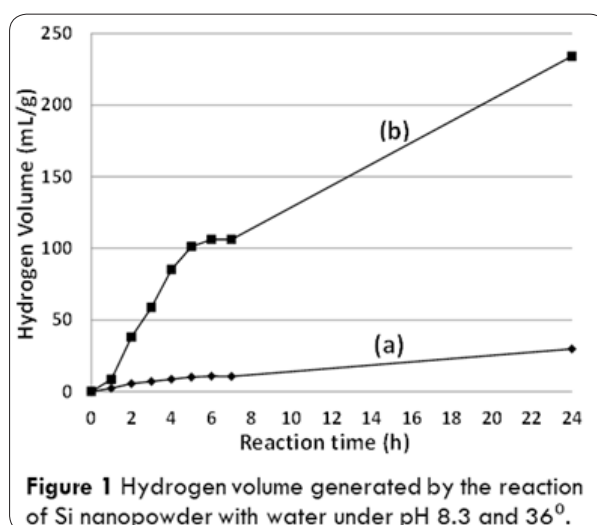


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Hydrogen generation by reaction of Si nanopowder with water for medical use

Hydroxyl radicals ($\cdot\text{OH}$) are generated in the body for various reasons, e.g. metabolism, smoking, alcohol, and stress. Hydroxyl radicals possess the highest oxidation-reduction potential among reactive oxygen species. Hydroxyl radicals oxidize cells to cause various diseases such as Alzheimer’s disease, Parkinson’s disease, and kidney failure. We have developed a method of hydrogen generation by the reaction of Si nanopowder with water having neutral pH. Si and SiO₂ are nonpoisonous materials, Si nanopowder can be taken to generate hydrogen in the body. The average crystallite size of Si nanopowder was 23.5 nm while it aggregated to form agglomerates with sizes larger than 0.1 μm . Due to the large size of agglomerates, Si nanopowder is expected not to be absorbed directly from digestive organs. On the other hand, the hydrogen generation rate was found to be dependent on the size of crystallites, but not on the size of agglomerates. Figure 1 shows the hydrogen volume generated by the reaction of Si nanopowder with water under conditions similar to those in bowels, i.e., pH 8.3 and 36°C. Without surface treatment of Si nanopowder, the hydrogen generation rate was very low. With the surface treatment, the hydrogen generation rate greatly increased and 240 mL hydrogen was generated in 24 h. It should be noted that 240 mL hydrogen corresponds to that included in 13 L saturated hydrogen-rich water. We found that hydroxyl ions act as catalyst for the hydrogen generation reaction. Therefore, Si nanopowder does not react in stomach with the acidic condition due to gastric acid (pH: 1.5~2.0) and it reacts in bowels under the alkaline condition because of pancreatic juices (pH: 7.8~8.7). Hydrogen generated in bowels are effectively absorbed, circulate in the body and eliminate hydroxyl radicals in the body. Therefore, Si nanopowder is expected to prevent various diseases caused by oxidation stress.



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Recent Publications

1. Y Kobayashi et al. (2017) Fabrication of Si nanopowder and application to hydrogen generation and photoluminescent material. J. Electric. Engineer. 68(7):17-23.
2. K Imamura et al. (2017) Reaction of Si nanopowder with water investigated by FT-IR and XPS. AIP Adv. 7 (8):085310.
3. Y Kobayashi et al. (2017) Hydrogen generation by reaction of Si nanopowder with neutral water. J. Nanopart. Res. 19(5) 176.
4. H Kobayashi et al. (2015) Technology of hydrogen generation by reaction of Si nanopowder produced from Si swarf and water. Fuel Cells, 15 (2015) 298-304.

Biography

Yuki Kobayashi worked for Takasago International Corporation after graduation of Kwansei Gakuin University, Nishinomiya, Japan. From 2012, he has been specially appointed as Researcher in the Institute of Scientific and Industrial Research, Osaka University, Japan. His research interest is materials related to foods and medicines. He is currently engaged in research on fabrication of nanomaterials for hydrogen generation and their application to medicines and foods.

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