Myung Gi Seo, J Nanomed Nanotechnol 2016, 7:5 (Suppl)
http://dx.doi.org/10.4172/2157-7439.C1.044

11th International Conference and Expo on
Nanoscience and Molecular Nanotechnology
October 20-22, 2016 Rome, Italy

Direct synthesis of hydrogen peroxide from hydrogen and oxygen over core-satellite nanocatalysts protected by a mesoporous silica shell

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Hydrogen peroxide is a very clean oxidizing agent generating only water as a by-product compared with other oxidizing agents. Currently, over 3.0 million metric tonnes of hydrogen peroxide is being produced annually by a well-known anthraquinone oxidation process. However, the anthraquinone oxidation process uses hazardous organic chemicals and it is suitable for mass production rather than small/medium sized production. To replace the anthraquinone oxidation process, the direct synthesis of hydrogen peroxide, which involves a direct reaction between hydrogen and oxygen, has come to the forefront of researchers' attention. Pd is mainly used as the catalyst in the direct synthesis of hydrogen peroxide. Many studies conducted focus on increasing the selectivity toward hydrogen peroxide by addition of acid and halide ions in reaction medium. In our previous study, a core@shell catalyst was introduced in the synthesis of hydrogen peroxide and it was found that the core@shell catalyst provided higher hydrogen conversion and hydrogen peroxide selectivity compared to using general supported catalysts. This phenomenon was attributed to the fact that the core@shell catalyst has a high Pd dispersion as the shell physically blocks the sintering of Pd particles in catalysts with a core@shell structure despite undergoing the calcination process at high temperatures. However, the catalyst with a core@shell structure is not efficient in mass transfer owing to the micropores on the outer shell. In response to this challenge, we introduced a silica-protected mesoporous core-satellite nanocomposite to improve the mass transfer process, which in turn increases the generation of hydrogen peroxide.

Biography

Myung Gi Seo has completed his PhD and Post-doctoral studies from Korea University.

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