

# Hydrogen large scale production technology from biomass waste thermal conversion process

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## **Abstract:**

With the depletion of fossil fuel sources as well as the global warming issues, the utilization of biomass or waste is getting increased attention as a potential source of renewable energy. This presentation will introduce the research and progress on biomass/waste gasification for hydrogen rich gas production.

During gasification process, high temperatures, high-pressure steam and sulfur containing compounds creates a severe environment for catalysts, so several attempts have been made to enhance the performance, and lots of kinds of catalysts and technologies were developed and applied.

Among these catalysts, there was one kind of special catalyst with reactive oxygen species (ROS) in the catalysts structure. Based on the research results, these catalysts exhibited high hydrogen production and superior resistance to carbon poisoned and/or sulfur-tolerant comparison to commercial catalyst because of these ROS. These kinds of the catalysts was summarized and illustrated respectively.

Mayenite is one kind of material with reactive oxygen species in the structure. It has been described previously as a calcium-aluminate framework, in which 32 of the 33 oxygen anions are tightly bound, containing large cages, 1/6 of them being filled randomly by the remaining "free oxygen". Mayenite ( $\text{Ca}_{12}\text{Al}_{14}\text{O}_{33}$ ) was developed and used in our group. Recently, "mayenite" as the nickel support was prepared in our lab, and exhibited excellent performance for biomass tar reforming. The special catalyst has higher "free oxygen" store ability. If the "free oxygen" was consumed in reduced environment, the "free oxygen" could restore in oxidation environment. The appearing and disappearing behavior of  $\text{O}_2^{2-}$  and  $\text{O}_2^-$  was detected by Raman spectroscopy for fresh and after reaction mayenite and Ni/mayenite, exhibited the restore ability of mayenite and Ni/mayenite. And also the series this kind of material were developed.

View the past research, "mobile oxygen" catalysts exhibited special performance in biomass gasification process, such as high hydrogen production, anti-carbon formation, improving sulfur toleration and so on. The development and application of these kinds of catalysts such as the low-cost metal Fe, simple perovskite and so on are attracting more research and focus. Research on the mechanism of the reactions is still imperative. These catalysts may be lead to reduction in the biomass gasification process.

Lastly, new technology and process for hydrogen production were summarized and introduced.

## **Keywords:**

Hydrogen production, biomass waste, thermal conversion, catalysts, technology