

## Research and development program of membrane IS process for hydrogen production using solar heat

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The thermochemical IS process is a hydrogen production method which thermally decomposes water in a cycle of chemical reaction using iodine and sulphur. It is expected to be a highly efficient hydrogen production technology with no carbon dioxide emission. The IS process is composed of three chemical processes of Bunsen reaction which is a production of hydrogen iodine (HI) and sulphuric acid (H<sub>2</sub>SO<sub>4</sub>), HI decomposition, and H<sub>2</sub>SO<sub>4</sub> decompositions as shown in **Fig. 1**.

The research and development program of the IS process using the membrane technology is now on progress aiming at improvement of the hydrogen production efficiency up to 40%. In the H<sub>2</sub>SO<sub>4</sub> decomposition reaction process, oxygen production process, the decomposition rate of sulphur trioxide (SO<sub>3</sub>) is expected more than 80% at the reaction temperature of 800 - 900°C. On the other hand, the decomposition rate of SO<sub>3</sub> decreases to around 30% in the reaction temperature of 600°C which temperature will be provided by solar heat, ceramic oxygen permselective membrane and catalyst have been developing to promote SO<sub>3</sub> decomposition in the reaction temperature of 600°C. In addition, the ceramic hydrogen permselective membrane and catalyst to promote HI decomposition for hydrogen production, the cation-exchange membrane and catalyst to reduce amount of iodine in the HI circulation process. Also, the corrosion-resistance material to use metal components in the H<sub>2</sub>SO<sub>4</sub> decomposition process is underway. In the FY2018, it is planned that the HI decomposition and hydrogen production will be demonstrated by using the membrane technology.

This presentation shows the outline of the research and development program of the membrane IS process.

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