Established output of Artificial photo synthesis project granted by NEDO and perspective view for its industrialization

(*Mitsubishi Chemical Corp. Science & Innovation Center*)　○Tohru Setoyama

Keywords: Artificial Photosynthesis, Photo catalyst, water splitting, CO_2 utilization, Reactive separation

It has passed 10 years since the start of ARPChem project at 2012. We have conducted four subjects as shown in Figure 1.

Development of photo catalyst for water splitting under visible light is the most important subject. Sun light conversion to hydrogen(STH) is the key index of catalytic activity. By the simulation study of economic feasibility of obtained green hydrogen, we concluded that 5% or more as STH is required. Furthermore, photo catalyst sheet by coating of powder catalyst on support is useful for the realization of cheap module of hydrogen production combined with safe & selective separation membrane. In order to compare the scalability by photocatalytic system, Figure 2 shows the comparison of output of photo electrode systems and photo catalyst sheet. While photo electrode system has trade-off relationship between activity and scalability, photo catalyst sheet could exceed its limit easily. 10% as STH and 1ha installation of photo catalyst sheet is the threshold of commercialization.

Figure 1 Four subjects of Artificial photo synthesis

AS a CCU technology, reactive separation of methanol synthesis is very attractive from LCA view point. By introducing zeolite membrane, Equilibrium limit can break easily, resulting in the very small recycle. Very selective conversion of methanol to requested olefin will be useful for realistic application of CO_2 as a differentiation from cracker process.

Figure 2 Scalability of photo catalyst sheet as a comparison with photo electrode for water splitting

We will show many results of four subjects in ARPChem project and argue their economic feasibilities. We think that the economic feasibility is the key for the commercialization of artifici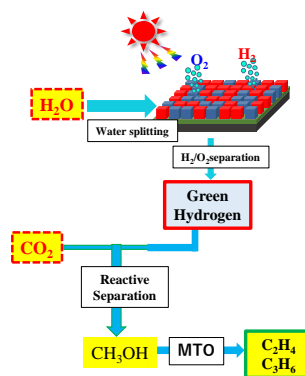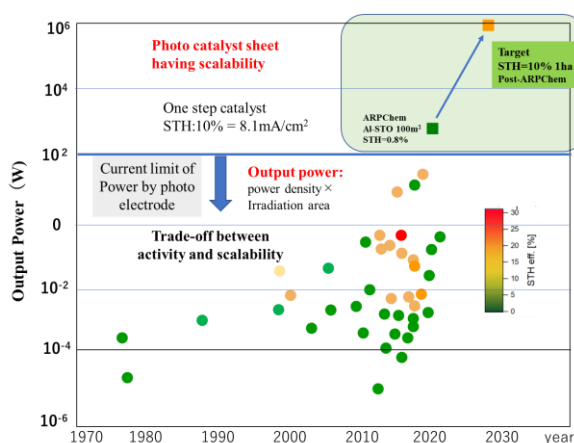al photo synthesis even it shows enough LCA improvement.