개질기 혼합영역 형상에 따른 반응물의 혼합도 및 가스상 반응특성에 대한 수치해석적 연구

*김 선영, **배 중면

Impact of mixer design to reactants mixing characteristics and gas-phase reactions in the mixing region of a hydrocarbon reformer

*Sunyoung Kim, **Joongmyeon Bae

Reactant mixing has a critical role in ensuring reformate quality and an important design objective is to achieve sufficiently complete mixture of reactants. For that purpose it is required to understand the coupled transport-kinetics phenomena in the mixing region. Three-dimensional computational fluid dynamics model was developed and validated in previous works. The mixing characteristics in various alternatives of a prototype mixing chamber were compared, and then a reduced reaction kinetics was applied to two extreme designs for investigating the impact of gas-phase reactions. Both designs did not reach threshold ethylene mole fraction of 0.001, but surprisingly more ethylene was generated in the design having better mixing characteristics. The presentation will deliver the development process of coupled transport and kinetics model briefly and the detailed information about the mixing characteristics and gas-phase reactions in two mixer designs.

Key words : Mixing(혼합), Mixer design(혼합기 형상), Reformer(개질기), Gas-phas reactions(가스상 반응)

E-mail : *chrysy@kaist.ac.kr, **jmbae@kaist.edu

텅스텐산화물/금속기판의 광전극 특성

*고 근호, pravin s. shinde, 서 선희, 이 동윤, **이 원재

Photoelectrochamical characteristics of WO_3 on metal substrate for hydrogen production

*GeunHo Go, Pravin Shinde, SeonHee Seo, Dongyoon Lee, **Wonjae Lee

Transparent conducting oxides (TCOs) supported on glass are widely used as substrates in PEC studies for photovoltaic hydrogen generation applications However, high sheet resistane (10~15 Ω/cm^2) and fragileness of glass-supported TCO substrates are the obstacles to produce the large area PEC cells.

Such internal sheet resistance is detrimental to efficient collection of photogenerated majority charge carriers at the photoactive material and electrolyte interface. Moreover, these TCO substrates are very expensive and consume about 40~60% cost of the devices.

Hence, a low sheet resistance of the substrate is a key point in improving the performance of PEC devices. Metallic substrates coated with a photoactive material would be a good choice for efficient charge collection. Such metal substrates based photanodes are best candidate for large-scale phtoelectrochemical water splitting for hydrogen generation.

In this study, we report the enhanced PEC performance of WO_3 film on metal(chemical etched, bare) substrate. It is proposed that interface between WO_3 and the metal substrate is responsible for efficient charge transfer and demonstrated significant improvement in the photoelectrochmical performance.

X-ray diffration and FESEM suduies reveled that WO_3 films are monoclinic, porous, polycrystalline with average grain size of ~50nm. Photocurrent of WO_3 prepared on metal substrates was measured in 0.5M H_2SO_4 electroyte under simulated 100mW/cm^2 illumination.

Key words : WO_3 photoanode(텅스텐산화물 광전극), Photoelectrochemical(광전기화학), Metal substrate(금속기판), hydrogen generation(수소생성), interface(계면), Scale-up(대면적화)

E-mail : *wjlee@keri.re.kr