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E-BABE- Ultrafast and efficient transport of hot plasmonic electrons by graphene for Pt Free, highly efficient visible-light responsive photocatalyst

Dong-Kwon Lim
Korea University KU-KIST Gradaute School of Converging Science and Technology Seoul, Republic of Korea

We recently report that reduced graphene-coated gold nanoparticles (r-GO-AuNPs) are excellent visible-light-responsive photocatalysts for the photoconversion of CO_2 into formic acid (HCOOH). The wavelength-dependent quantum and chemical yields of HCOOH shows a significant contribution of plasmon-induced hot electrons for CO_2 photoconversion. Furthermore, the presence and reduced state of the graphene layers are critical parameters for the efficient CO_2 photoconversion because of the electron mobility of graphene. With an excellent selectivity toward HCOOH (>90%), the quantum yield of HCOOH using r-GO-AuNPs is 1.52%, superior to that of Pt-coated AuNPs (quantum yield: 1.14%). This indicates that r-GO is a viable alternative to platinum metal. The excellent colloidal stability and photocatalytic stability of r-GO-AuNPs enables CO_2 photoconversion under more desirable reaction conditions. These results highlight the role of reduced graphene layers as highly efficient electron acceptors and transporters to facilitate the use of hot electrons for plasmonic photocatalysts. The femtosecond transient spectroscopic analysis also shows 8.7 times higher transport efficiency of hot plasmonic electrons in r-GOAuNPs compared with AuNPs.

Biography

Dong-Kwon Lim is an assistant professor at KU-KIST Graduate School of Science and Technology in Korea University (Seoul, South Korea) (2015 ~ current). After he finished his BS and MS degree of Chemistry from Kyungpook National University (1996), he worked for more than 10 years in the pharmaceutical research institutes of the company in Korea. After he received his Ph. D. degree of Chemistry from Seoul National University in 2011, he started his postdoctoral research at MIT (David H Koch Institutes, Advisior: Prof. Robert Langer Lab) and Harvard Medical School (Children's Hospital Boston) (2011~2013). Dr. Lim has made pioneering contributions to the field of DNA-based nanostructure synthesis for single molecule surface-enhanced Raman scattering (SERS) and the developments of new bio detection & therapeutic strategies based on organic/inorganic hybrid nanomaterials.

dklim@korea.ac.kr

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