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Laser Vaporization and Controlled Condensation (LVCC): Graphene supported Pd/Fe3O4 Nanoparticles as an Efficient Magnetic Catalyst for Suzuki Cross – Coupling.

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Abstract

A reproducible, reliable, and highly efficient synthetic approach was implemented for synthesis of palladium nanoparticles supported on a binary composite of Fe_3O_4 and graphene (Pd-Fe_3O_4/G). This unique catalyst was tested for being used as a highly efficient active catalyst for being used in Suzuki cross – coupling reactions. It was found that this graphene supported Pd/Fe_3O_4 nanoparticles (Pd-Fe_3O_4/G) has a remarkable catalytic activity towards Suzuki coupling reactions. This catalyst could be recycled for up to three times with high catalytic activity. The catalyst was prepared using LVCC synthetic approach; the prepared catalyst was found to be highly magnetic which enabled the separation process of the catalyst via applying an external magnetic field using a strong magnet. This adopted synthetic approach has many advantages including recyclability, mild reaction conditions, and reproducibility. The high catalytic performance is due to the catalyst-support strong interaction. Moreover, the defect sites found on reduced GO nanosheets act as nucleation centers providing a platform to anchor Pd and Fe_3O_4 nanoparticles and hence avoid the potential agglomeration and subsequently the anticipated decrease in the catalyst catalytic activity as a direct impact for this unfavorable agglomeration.

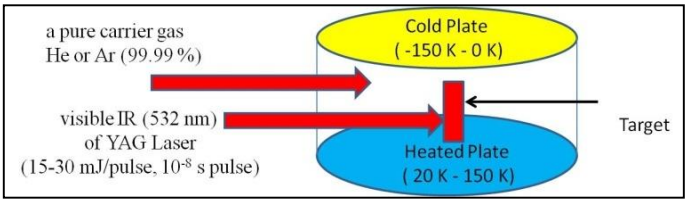

Figure 1 Experimental set-up for LVCC synthesis of nano particles

Recent Publications

1. Hany A. Elazab, M. A. Sadek, and Tamer T. El-Idreesy (2018) Microwave-assisted synthesis of palladium nanoparticles supported on copper oxide, Adsorption Science and Technology, 36:1352-1365.
2. Hany A. Elazab, S. Moussa, Kendra Woodberry, B. Frank Gupton, and M. Samy El-Shall, (2017), Microwave-Assisted Synthesis of Pd/Fe_3O_4 Nanoparticles under flow reaction conditions, Journal of Green Processing and Synthesis (GREENPS), 6:413.
3. Hany A. Elazab, S. Moussa, Ali Siamaki, B. Frank Gupton, and M. Samy El-Shall, (2017), The Effect of Graphene on catalytic performance of Palladium Nanoparticles decorated with Fe_3O_4, Co_3O_4, and Ni $(OH)_2$, Catalysis Letters, 1510–1522.
4. Hany A. Elazab, Ali Siamaki, S. Moussa, B. Frank Gupton, M. S. El-Shall, (2015), Highly Efficient and Magnetically Recyclable Graphene-Supported Pd/Fe_3O_4 Nanoparticle Catalysts, Journal of Applied Catalysis A: General, 491:58-69.
5. Hany A. Elazab, S. Moussa, B. Frank Gupton, M. S. El-Shall, (2014) Microwave-assisted synthesis of Pd nanoparticles for CO oxidation, Journal of Nanoparticle Research, 16:2477

Biography

Dr. Hany Elazab is a senior Assistant Professor and Program Director of the chemical engineering department at British University in Egypt (BUE). He was awarded his Ph.D from (VCU) in USA. He participated in several research projects in Nanotechnology, Catalysis, and Micro Reactor Technology funded from (NSF) in USA. He also awarded Young Investigator Research Grant (YIRG) and High Impact Research Award from the British University in Egypt (BUE). He is teaching courses of engineering thermodynamics, catalysis, mass and energy balance, chemical engineering thermodynamics, and petrochemical production processes. He has published several research contributions to international journals, proceedings and international conferences. He is also participating as a reviewer and editorial board member in several international journals in catalysis, nanotechnology, chemical and environmental engineering.