Graphitic carbon nitride: photocatalyst for photocatalytic processes

Beata Zielińska, Daria Baranowska

West Pomeranian University of Technology in Szczecin, Faculty of Chemical Technology and Engineering, Department of Nanomaterials Physicochemistry

Piastow Ave. 45, 70-311 Szczecin, Poland

bzielinska@zut.edu.pl

Graphitic carbon nitride (GCN) is considered as a promising multifunctional catalyst for many processes such as photocatalytic H_2 and O_2 evolution, photocatalytic degradation of organic and inorganic pollutants, CO_2 reduction and other energy conversion processes. However, in the case of photocatalysis, three main drawbacks of the bulk GCN seriously limit its wide practical application: (i) ineffective utilization of visible light via absorption of narrow part of the solar energy (>460 nm), (ii) fast recombination of photogenerated carriers (e^-, h^+), and (iii) quite small surface area. Thus, in order to resolve above mentioned restrictions of GCN, researchers are working on the construction of hybrids based on GCN which allow to receive desirable features of material.

Here, spherical hybrid photocatalysts based on GCN and mesoporous carbons have been synthesized. Carbon spheres such as ordered mesoporous hollow carbon spheres (OCS), disordered mesoporous hollow carbon spheres (DCS) and ordered mesoporous carbon spheres (CS) were used as cores of the hybrids. The photocatalytic performance of the obtained materials were studied in the reaction of H_2 generation and dye decomposition under simulated solar light irradiation. The results revealed that coupling of GCN with mesoporous carbon allows to form the photocatalysts with superior photocatalytic performance. For example, the photoactivity of CS/GCN in the reaction of Acid Red 18 decomposition was over 7.5 times higher than that of the bulk GCN. It is due to that introducing mesoporous carbon into hybrid photocatalysts induced higher surface area of the heterojunction and also facilitated the contact surface between the two phases. Moreover, the synergistic effect between those two components enhanced the visible light-harvesting efficiency and improved photoinduced charge carriers generation and consequently their proper separation.