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## Recent progress on visible light responsive heterojunctions for photocatalytic applications

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**Abstract:** Photocatalysis has attracted much attention in recent years due to its potential in solving energy and environmental issues. Even though numerous achievements have been made, the photocatalytic systems developed to date are still far from practical applications due to the low efficiency and poor durability. Efficient light absorption and charge separation are two of the key factors for the exploration of high performance photocatalytic systems, which is generally difficult to be obtained in a single photocatalyst. The combination of various materials to form heterojunctions provides an effective way to better harvest solar energy and to facilitate charge separation and transfer, thus enhancing the photocatalytic activity and stability. This review concisely summarizes the recent development of visible light responsive heterojunctions, including the preparation and performances of semiconductor/semiconductor junctions, semiconductor/cocatalyst junctions, semiconductor/metal junctions, semiconductor/non-metal junctions, and surface heterojunctions, and their mechanism for enhanced light harvesting and charge separation/transfer.

**Key words:** heterojunction, photocatalysis, water splitting, carbon dioxide reduction, organic pollutant degradation, Z-scheme, visible light, semiconductor, surface heterojunction

### 1. Introduction

Global energy shortage and climate change have become the main challenges for humanity in the 21<sup>st</sup> century, thus developing alternative clean and renewable energy with high efficiency is of great significance<sup>[1]</sup>. Efficient utilization of renewable solar energy for producing zero carbon fuels from various approaches including photocatalytic water splitting, generating

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