

## Microwave-Assisted Hydrogen Generation from HDPE using Iron-Based Catalysts

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### Abstract:

The demand for hydrogen is increasing due to the rapid development of decarbonized societies worldwide. Simultaneously, the increase in plastic waste is a global problem requiring urgent solutions. This study investigates hydrogen production from plastic waste, addressing both of these challenges. The research aims to elucidate the effect of microwaves on the catalyst-plastic reaction by analyzing the composition of the generated gas and the temperature distribution of the reactants. The goal is to generate high-purity hydrogen at a lower microwave power. In experiments using 1g of HDPE (high-density polyethylene) with varying microwave power, By using approximately three times the amount of catalyst as in previous studies, 1,200 ml of hydrogen generation and a hydrogen yield of approximately 75% were achieved at 150 W. Temperature distribution analysis using a two-dimensional pyrometer revealed that carbon nanotubes generated during HDPE decomposition effectively absorb microwaves, creating localized hot spots exceeding 1200°C. This suggests that efficient hydrogen production can be achieved even at low microwave power through the sequential reaction of HDPE and the catalyst in the vicinity of these high-temperature regions.

### Keywords:

Hydrogen, Plastic, Recycling, Microwave, Waste management.