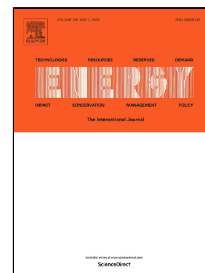


# Accepted Manuscript

Study on the Synergism of Steam Reforming and Photocatalysis for the Degradation of Toluene as a Tar Model Compound under Microwave-Metal Discharges



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1           **Study on the Synergism of Steam Reforming and**  
2           **Photocatalysis for the Degradation of Toluene as a Tar**  
3           **Model Compound under Microwave-Metal Discharges**

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8           **Abstract** The synergism of steam reforming and photocatalysis on converting the tar  
9           model compound toluene was investigated in a microwave (MW)-metal discharge  
10          reactor, using anatase TiO<sub>2</sub> as photocatalyst and N<sub>2</sub> and N<sub>2</sub>+Ar as carrier gas. Unlike  
11          dry-state cracking that generates noticeable soot, MW-metal discharge steam reforming  
12          can effectively eliminate soot formation and promote the conversion of toluene into  
13          permanent gases. The toluene conversion in steam reforming can be further enhanced  
14          by employing photocatalyst. However, the photocatalytic performance largely depended  
15          on the carrier gas and humidity. Compared with N<sub>2</sub>, the introduction of Ar into N<sub>2</sub>  
16          intensified the UV light emission to trigger photocatalytic degradation of toluene. The  
17          toluene conversion efficiency under the synergetic effects of photocatalysis and steam  
18          reforming reached 98% when Ar/N<sub>2</sub> = 1/5 (v/v) was used as the carrier gas with a  
19          moderate humidity of 38%. However, toluene was less effectively photodegraded as  
20          humidity increased high (> 60%), mainly attributed to competitive adsorption between  
21          toluene and water molecules on the active sites of photocatalyst as well as the reduction

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