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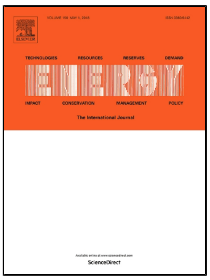

Study on the Synergism of Steam Reforming and Photocatalysis for the Degradation of Toluene as a Tar Model Compound under Microwave-Metal Discharges

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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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Abstract The synergism of steam reforming and photocatalysis on converting the tar model compound toluene was investigated in a microwave (MW)-metal discharge reactor, using anatase TiO_2 as photocatalyst and N_2 and N_2+Ar as carrier gas. Unlike dry-state cracking that generates noticeable soot, MW-metal discharge steam reforming can effectively eliminate soot formation and promote the conversion of toluene into permanent gases. The toluene conversion in steam reforming can be further enhanced by employing photocatalyst. However, the photocatalytic performance largely depended on the carrier gas and humidity. Compared with N_2, the introduction of Ar into N_2 intensified the UV light emission to trigger photocatalytic degradation of toluene. The toluene conversion efficiency under the synergetic effects of photocatalysis and steam reforming reached 98% when Ar/N_2 = 1/5 (v/v) was used as the carrier gas with a moderate humidity of 38%. However, toluene was less effectively photodegraded as humidity increased high (> 60%), mainly attributed to competitive adsorption between toluene and water molecules on the active sites of photocatalyst as well as the reduction