以光催化反應器分解室內空氣之甲苯

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摘 要

本研究探討二氧化鈦可見光觸媒對於低濃度甲苯之光催化分 解特性。使用3 種不同光觸媒塗層，分3 階段進行系統測試。第 一階段研究使用兩種觸媒塗層，合成方法包括： (1)以四異丙酮 基鈦 (Titanium tetraisopropoxide) 為先驅物，以溶凝膠法合 成二氧化鈦鍍膜液，並以浸鍍法(dip-coating) 塗布於玻璃管內 壁，以製作光觸媒塗層；(2)以Degussa P25 添加適量水與界面 活性劑調配鍍膜液，其餘方法同(1) 。測試時反應器照射低強度 紫外線(300~400nm)。結果顯示： 兩種光觸媒皆能有效分解低濃 度甲苯，然而當甲苯濃度增加，則相同反應條件下之甲苯分解率 明顯降低，尤其是Degussa P25 鍍膜系統， 當甲苯初始濃度由 0.5 ppm增至6 ppm時，甲苯分解率隨之由 88%降至8%。相較之下，以溶凝膠法合成之二氧化鈦光觸媒，更能有效分解較高濃度之 甲苯，當甲苯初始濃度增至2 ppm(氣體流量為200 ml min-1)時，在相同紫外線照射下，仍可將其完全分解。第2 階段測試系統 使用色素增感型(Dye-sensitized) TiO2可見光觸媒，TiO2可 為 Degussa P25 或溶凝膠法合成之TiO2奈米粒子塗層，光源使用家 用日光燈。結果顯示：僅以溶凝膠法合成之Dye-sensitized TiO2 奈米光觸媒塗層於可見光照射時呈現明顯之光觸媒活性，但活性 較第1 階段測試系統使用者為差。在低甲苯初始濃度時 (甲苯濃 度0.5 ppm，氣體流量200 ml min-1)，甲苯分解率僅達 35%。值 得注意的是：當上述Degussa P25 合成之 Dye-sensitized TiO2 奈米光觸媒塗層經過酸處理後，該系統開始顯現可見光光觸媒活 性，在低甲苯初始濃度時(甲苯濃度0.5 ppm，氣體流量 200 ml min-1)，甲苯分解率達48%， 顯現酸處理對此型觸媒活 性之影響。為了比較上述自行合成之光觸媒與商用觸媒活性之異 同，第2 階段測試以廠商所提供之商用光觸媒樣品(Ag/TiO2)進 行相同條件之測試，以為對照。結果顯示：此一樣品於可見光照 射時，對於低濃度甲苯幾乎沒有光催化活性。

關鍵詞 : 色素增感型TiO2、室內空氣、光催化、甲苯、可見光

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