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基于热重红外联用分析的PE、PS、PVC热解机理研究

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Study on the pyrolysis mechanism of polyethylene, polystyrene, and polyvinyl chloride by TGA-FTIR

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摘要 利用TGA-FTIR联用技术考察了PE、PS、PVC三种典型塑料的热解特性。结果表明,热稳定性从弱到强依次为PVC、PS、PE。PE热解反应过程为典型的一段式反应,红外光谱分析结果表明,PE热解过程为无规则断链形式,生成产物成分复杂,且随热解过程而改变,开始以饱和烃基团为主,中后期以烯烃基团为主,同时有少量炔烃;PS热解过程同样为一段式反应,红外光谱显示主要热解产物为苯乙烯单体,说明热解过程主要是苯乙烯的解聚过程;PVC热解过程较为复杂,主要分为脱氯阶段和共轭多烯重构阶段,红外光谱结果表明,产物中有芳香族化合物。脱氯过程和共轭多烯重构、环化过程在时间和空间上有重合,给二噁英类污染物的生成制造了可能。

关键词： PE　PS　PVC　TGA-FTIR联用　热解机理

Abstract： The pyrolysis behaviors of three kinds of typical plastics like polyethylene (PE), polystyrene (PS) and polyvinyl chloride (PVC) were investigated through thermal gravimetric analysis (TGA) and Fourier transform infrared spectroscopy (FTIR). The results showed that the thermal stability of these plastics increases following the sequence of PVC < PS < PE. PE pyrolysis is a typical one-stage reaction and involves irregular chain scission; the products of PE pyrolysis are complicated and changed gradually during the pyrolysis process: alkanes are the main products in the preliminary stage, while alkenes with trace amount of alkynes are the main products in the rest of pyrolysis process. PS pyrolysis is also a typical one-stage reaction with styrene as the main product, which suggests that the main reaction is depolymerization of PS to styrene monomer. PVC pyrolysis includes two events, i.e. dechloridation of PVC and rearrangement of conjugated polyene, in which aromatic compounds were found in the pyrolysis products; the dechloridation of PVC and the rearrangement and cyclization of conjugated polyene may take place simultaneously, which creates the potential for producing dioxin during PVC pyrolysis.

Key words： PE　PS　PVC　TGA-FTIR　pyrolysis mechanism

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