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低阶煤温和液化特征分析

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Study on mild liquefaction of lower rank coal

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摘要 利用管弹反应器考察了霍林郭勒褐煤在温和条件下的液化特征,探讨了温度、溶剂、压力、气氛、催化剂对液化产物分布的影响;分别利用程序升温热解技术和红外光谱分析了液化产物中己烷不溶物的气态烃逸出规律和结构特征;利用凝胶渗透色谱、同步荧光光谱和红外光谱分析了不同反应条件下产物沥青烯和前沥青烯的结构特征。结果表明,实验条件下霍林郭勒煤的起始热解液化温度在350℃左右;随温度的升高,液化转化率增大。较高温度时(450℃)缩聚反应加剧,液化转化率开始减小;溶剂对沥青烯类产物的生成极为重要,提高反应压力和添加催化剂主要促进油气的生成;温和条件下(350、400℃)对霍林郭勒煤的临氢处理,可获得热解反应性较原煤高的液化残渣(己烷不溶物);产物沥青烯和前沥青烯的分子量在液化温度为300和350℃时为最大;随反应温度升高,沥青烯和前沥青烯的芳烃结构特征增强,烷烃结构特征减弱。

关键词: 温和液化　低阶煤　沥青烯　前沥青烯

Abstract: The behaviors of mild liquefaction of a lower rank coal (HL lignite) were investigated using a tube bomb reactor with respect to the influence of reaction temperature, solvent, initial pressure, atmosphere and catalyst. TPD-FID(temperature programmed decomposition-flame ionization detector)and FT-IR were used to study the properties of liquefaction residues (hexane insoluble part). The gel permeation chromatography, synchronous fluorescence and infrared spectroscopy were used to study the structure characteristics of asphaltenes (A) and preasphaltenes (PA) produced. The results show that the notable liquefaction of HL lignite starts at about 350℃. The increase of liquefaction yield increases with the increase of the temperature. As the condensation reaction becomes significant at the higher temperature (450℃), the liquefaction yield starts to decline. The solvent can significantly improve the yields of A+PA. The increase of reaction pressure and the addition of catalysts mainly lead to an increase of Oil+Gas (O+G) yield. The liquefaction residue (hexane insoluble) obtained under mild conditions has a higher pyrolysis reactivity than its parent coal. When the liquefaction temperature is higher than 300℃(350℃), the molecular weight and the paraffinic characteristics of asphaltene (preasphaltene) decrease with liquefaction temperature.

Key words: mild liquefaction　lower rank coal　asphaltene　preasphaltene

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