

论文

二氧化碳与煤作用机理的实验研究

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摘要:

为了探讨CO2与煤的作用机理,采集了山西省霍州和晋城地区煤样进行He, N2和CO2氛围中的差示扫描量热(DSC)实验.结果表明:在He氛围中,3条DSC曲线较平直;在N2氛围中,DSC曲线总体平滑,较He中的曲线上移;而在CO2氛围中,DSC曲线出现了明显的放热峰和吸热峰,3条曲线形态各异.分析认为:He为惰性气体,不会在煤表面吸附,故没有焓释放;N2可以在煤表面发生物理吸附,这导致较小焓的释放.CO2氛围中较大的焓变化表明,CO2除了可以与煤孔隙界面发生物理作用,还可能与含氧基发生化学作用.通过分析煤的反应性、CO2的反应性及类比CO2与其他物质的作用特征,提出了如下解释:煤大分子向CO2提供电子,生成了电子给体受体络合物(EDA络合物),即发生了化学反应,放热峰出现.升温时,CO2-EDA络合物所在基团与煤中其他基团间的交联作用减弱,易于断裂,吸热峰出现.DSC曲线形态的不一致,表明煤体结构发生了变化.

关键词: 煤; CO2; He; N2; 差示扫描量热

Experimental study on CO2-coal interactions

Abstract:

In order to probe CO2-coal interactions,differential scanning calorimetry(DSC) experiment was carried out in the atmosphere of He,N2 and CO2 with coals from Huozhou and Jincheng area in Shanxi Province.The results show that,in a He atmosphere,the curves are straightforward,the curves in the N2 atmosphere are smooth and upward compared with curves in the He atmosphere,however,in a CO2 atmosphere,all the three curves show exothermic peaks and endothermic peaks are irreversible.It is proposed that,as an inert gas,He can't be adsorbed on coal surface,hence no enthalpy released.For N2,physical adsorption occurs,charactered with lower enthalpy releasing.The larger enthalpy variation in a CO2 atmosphere indicates that,except for physical reactions,chemical reactions may also occur.Based on the analysis of coal interactions,CO2 interactions and molecular-scale interactions of CO2 with substances other than coal,the CO2-coal interactions were explained as follows: the C atom of CO2 accepted electrons from coal molecular,and formed an "electron donor-acceptor complex" (i.e.,an "EDA complex"),in other words,chemical reactions occured,hence exothermic peaks occured.The interconnections of the active sites to other groups in coal molecular are weakened due to the formation of EDA complex,so to be easily broken during heating,hence endothermic peaks occured.The irreversibility of the curves indicates that coal structure is changed.

Keywords: coal; CO2; He; N2; differential scanning calorimetry(DSC)

收稿日期 2011-11-11 修回日期 2012-03-14 网络版发布日期 2012-05-24

DOI:

基金项目:

国家自然科学基金资助项目(40772096, 40972108)

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