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可再生能源发电

热解过程中玉米秆颗粒孔隙结构的演化

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摘要： 利用氮气等温吸附/脱附法(-196 ℃)和扫描电镜(scanning electronic microscopy，SEM)等研究了热解过程中玉米秆颗粒孔隙结构的演化，并用分形维数来描述焦颗粒内部孔隙表面形态的复杂程度。结果表明，热解温度对生物质焦的孔结构和表面形态有显著影响。在热解过程中，焦中孔的形状发生了一定的变化，各种孔的比例有了较大变化，且孔径有先变小后变大的趋势。高温导致焦颗粒发生塑性变形，使得孔隙扩大和孔表面更加光滑。随着温度的升高，玉米秆焦的BET比表面积经历一个先减小后增大再减小的过程，500 ℃以前，孔容积的变化规律与比表面积相近，但当温度高于500 ℃时，比表面积在减小，而孔容积在增大。通过分形FHH方程回归得到的分形维数DFHH能较好地表征颗粒内部孔隙表面的分形特征。其分形特征与热解温度密切相关，分形维数DFHH的变化与BET比表面积SBET有一定关联。

关键词： 玉米秆 热解 孔隙结构 吸附/脱附 分形维数

Evolution of Pore Structure of Maize Straw Particles During Pyrolysis

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Abstract: The changes in pore structure characteristics of maize straw (MS) particles during pyrolysis were studied. The samples were characterized by N2 isothermal adsorption/ desorption method and scanning electronic microscopy (SEM). The results indicate that pyrolysis temperature has a notable impact on the pore structue and morphology of biomass char. Pyrolysis temperature is found to influence the size and the shape of char particles. High temperature leads to plastic deformation of particles resulting in smooth surfaces and large cavities. Brunauer-Emmett Teller (BET) specific surface area SBET undergoes a complex process during pyrolysis: firstly decreases to 1.518 m2/g at 250 ℃, increases to a maximum value of 7.345 m2/g at 500 ℃ subsequently and then decreases to 4.684 m2/g at 900 ℃ again. The change of pore volume is similar to that of BET specific surface area below 500 ℃, however, at higher temperature pore volume increases while BET specific surface area decreases gradually. The fractal dimension DFHH calculated by fractal Frenkl-Halsey-Hill (FHH) equation could represent pore structure satisfactorily. The fractal analysis shows that pyrolysis temperature has close relation to DFHH. There are some correlations between the fractal dimension DFHH and BET specific surface area SBET.

Keywords: maize straw pyrolysis pore structure adsorption/desorption fractal dimension

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