

Study on the structure and gasification characteristics of selected South African bituminous coals in fluidised bed gasification

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Abstract

The gasification characteristics of three South African bituminous coals were investigated in a bubbling fluidised bed reactor. The three coals are similar in rank, but two are inertinite-rich coals and the third has a high vitrinite content. The microstructural characteristics of the parent coals and their resultant chars were determined using XRD, FT-IR, Raman and petrographic analysis. The microstructural changes that occurred in the organic (maceral) and the inorganic (mineral) fractions of the selected coals were evaluated. The change in the carbon structure was correlated to the proportions of inertinite and vitrinite macerals in the coals. High vitrinite content resulted in an increase in the order of the disordered carbon structure after gasification and this leads to greater graphitised ordered carbon structures. While a high inertinite content resulted in low or no structural transformation of the chemical structure. The transformation of inorganic mineral constituents of the coal was correlated to the amount of inertinite present in the selected coals. Higher proportions of inertinite macerals and inertinitic chars resulted in higher proportions of melted minerals. Char samples with low proportions of organic matter resulted in higher proportion of melted minerals covering the char surface.