EFFECT OF SOLVENT DISTILLATE IN THE COAL AND VACUUM RESIDUE CO-PROCESSING

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Abstract:

With the crude oil becoming heavier and more inferior, the content of carbon residue and metal in vacuum residue are higher and higher. Traditional processes such as catalytic cracking and fixed bed hydro-cracking are not suitable for some of these kinds of vacuum residue. Hydro-treatment of vacuum residue in slurry bed gets people's attention. Coal, another hydrocarbon resource, is also being researched to be processed into liquid fuel. Due to the feature of vacuum residue and coal, recycle distillate is necessary in the coal and residue co-processing. Fe catalyst is widely used in the residue slurry-bed process and coal direct liquefaction process.

The target of this work was to evaluate the effect of solvent distillate in the coal and residue co-processing. Experiments of BLG coal and Tahe vacuum residue co-processing were held in autoclave with high pressure hydrogen, high temperature and Fe loaded in the coal as catalyst. FJYJ was used as solvent distillate with boiling range from 343 to 509°C. Coal and vacuum residue slurry mixture without solvent distillate were operated at 683, 693, 703, 713 K and an initial hydrogen pressure of 9.5MPa. In this series of experiments, the highest conversion rate of >524°C organic matter in the BLG coal and Tahe vacuum residue slurry was 62.24% at 713 K. And the coke yield of experiment operated at 713 K was 5.49%. With 50% FJYJ added into coal and vacuum residue slurry, the highest operating temperature can be increased to 728°C with coke yield <5%. The conversion rate of >524°C organic matter in the BLG coal and Tahe vacuum residue slurry was 72.63% at 728 K. With 50% FJYJ pre-hydrogenation with Ni-Mo-W catalyst added into coal and vacuum residue slurry, the conversion rate of >524°C organic matter in the BLG coal and Tahe vacuum residue slurry was 83.58% at 728 K.

Ultimate analysis and GC-MS study of FJYJ and FJYJ hydrogenation with Fe catalyst and Ni-Mo-W catalyst in autoclave were also researched. The results showed that the H/C ratio was hardly increased after hydrogenation with Fe catalyst and the H/C ratio was increased from 0.97 to 1.15 after hydrogenation with Ni-Mo-W catalyst, respectively. GC-MS study showed that particular compounds in FJYJ may benefit for transmit hydrogen atom.

Keywords: coal and residue co-processing, solvent distillate

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