

Synthesis and performance of a comblike amphoteric polycarboxylate dispersant for coal–water slurry

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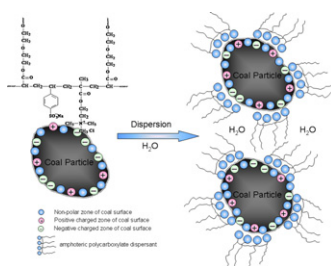
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HIGHLIGHTS

- AmPC has better performance than the traditional polycarboxylate dispersant in CWS.
- We draw a schematic to illustrate the dispersion mechanism of AmPC with coal in CWS.
- It can provide anchoring action with coal via adsorption of ion pairs.
- It possesses not only dramatic wetting on coal but also stable steric hindrance.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 20 April 2012

Received in revised form 11 July 2012

Accepted 15 July 2012

Available online 27 July 2012

Keywords:

Comblake polycarboxylate
Amphoteric polycarboxylate dispersant
Coal–water slurry (CWS)
Apparent viscosity
Stability

ABSTRACT

A novel comblike polymer, amphoteric polycarboxylic (AmPC), was designed as a dispersant for coal–water slurry (CWS) and synthesized in aqueous solution from the copolymerization of macromonomer polyethylene glycol–acrylate monoester (PA), sodium p-styrene sulfonate (SSS) and cationic comonomer methacrylateethyl trimethyl ammonium chloride (DMC). PA was prepared by esterifying with polyethylene glycol (PEG) and acrylic acid (AA) in our laboratory. And then, the molecule structure of amphoteric polycarboxylic dispersant was characterized by means of Fourier transformer infrared (FTIR). Besides, the dispersant was applied in Shenfu coal slurry. By examining the apparent viscosity of the coal slurry using rheometer, the effects of the mole ratio of SSS and PA, amount of cationic monomer DMC, initiator concentration and reaction temperature on the AmPC dispersant performance were discussed. The wetting property of AmPC dispersant on the coal surface and Zeta potential of the CWS with AmPC dispersant was measured. The result shows that the apparent viscosity decrease of amphoteric polycarboxylic dispersant is better than the dispersant in stock which does not have cationic monomer when the dosage of DMC is 5.0 wt%. It has been proved that the amphoteric polycarboxylic dispersion agent is suitable for Shenfu coal slurry. When the dosage of AmPC dispersant is up to 0.3 wt%, the highest concentration of coal-slurry can reach 65.0 wt%. AmPC dispersant with both anionic group and cationic group will provide the better anchoring action with the coal via the adsorption of ion pair. It possesses not only dramatic wetting on coal but also stable steric hindrance so as to disperse coal particles in water.

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1. Introduction

Coal–water slurry (CWS) technology was developed during the world wide oil crisis of the 1970s to produce a novel and clean fluid fuel as a substitute for petroleum. The slurry is prepared as a mixture of 60–70% fine coal, 29–39% water, and about 1%

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