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(54) **Method for the removal of iron pyrites from coal and carbon structures during ash removal by chemical means.**

(57) The invention relates to a method for the removal of iron pyrites from coal and carbon structures during ash removal by chemical means. The method includes crushing raw coals to a proper particle size, leaching said crushed coals with hydrofluoric acid, and separating said leached solids.

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The present invention relates to a method for the removal of iron pyrites from coal and carbon structures during ash removal by chemical means.

Iron pyrites (FE S2) is an undesirable impurity in coal.

The most commonly employed methods for pyrite removal from coal rely on differences in physical properties between pyrites and coal particles. Flotation relies on surface properties, gravity separation relies on density, and magnetic separation relies on magnetic properties.

Therefore, in order to remove most pyrites from coal, it is necessary to liberate the pyrites particles from the organic coal matrix, that is, to separate the pyrites particles from the coal particles.

Pyrites is commonly distributed within the coal matrix as pyrites particles laminated to the organic coal matrix, often with intermediate bonding by inorganic mineral matter such as aluminosilicates.

Conventional removal methods achieve pyrites liberation by grinding the coal, the finer the grind the more complete is the liberation. However, fine grinding is expensive and often introduces downstream processing or utilisation disadvantages.

Our invention has as its objective a method which liberates pyrites from coal without the necessity for fine grinding.

In its broadest form the invention provides a method for liberating pyrites from coal comprising crushing coal to a suitable particle size; leaching the crushed coal with hydrofluoric acid, and treating the leached solids using

otherwise conventional pyrites removal methods.

The suitable particle size range varies from coal to coal, however it is coarser in size than that necessary for satisfactory conventional liberation of pyrites. The hydrofluoric acid dissolves most of the inorganic minerals within the coal matrix, including the predominant aluminosilicates, but not the pyrites thereby breaking the bond between the pyrites and the organic coal matrix, and liberating the pyrites particles. Conventional pyrites removal methods such as gravity separation, magnetic separation, and flotation can then be employed. Gravity separation is particularly enhanced as the organic coal matrix achieves a lower than normal density after hydrofluoric acid leaching, due to the dissolution of ash-forming minerals, thereby increasing the density difference between the pyrites refuse and the coal accepts.

The hydrofluoric acid leaching conditions are not critical with respect to acid concentration, temperature or leaching time. We have successfully employed acid concentrations of about 3 to 70 w/w%, temperatures of 20 to 100°C and leaching times from about 10 minutes to 48 hours.

The raw coal must be crushed to a particles size suitable for hydrofluoric acid leaching. It is necessary to reduce the particle size only to that extent required to provide access for the hydrofluoric acid leach liquor to the mineral matter associated with the coal matrix. It is not necessary to completely liberate the mineral particles, which would require finer grinding. Accordingly, relatively coarse coal particles can be acid leached and then treated for pyrites removal. Liberation of pyrites by grinding alone

would only be achieved at much finer particle sizes. We have achieved excellent pyrites removal from coal by hydrofluoric acid leaching raw coal at particle sizes as coarse as 5mm, and then using conventional separation methods.

EXAMPLE A:

Using a coal with .9% sulphur, approximately .4 of which is pyritic, the following results were obtained: crushing the coal to 2mm minus and drying, the coal was then subjected to a heavy media wash and it was found sulphur was reduced by approximately .02%. A sample of the same coal crushed to 2mm minus and subjected to the hyrdofluoric wash detailed earlier was then treated to a heavy media wash in the same conditions as the untreated sample; residual sulphur was then found to be 0.4%. More than 99% of the pyritic sulphur was removed.

C L A I M S :

1. A method for the removal of iron pyrites from coal and carbon structures comprising the steps of crushing raw coals to a proper particle size, leaching said crushed coals with hydrofluoric acid, and separating said leached solids.

2. The method of clim 1, said leaching with hydrofluoric acid is carried out in the conditions of acid concentrations of about 3 to 70 percent of weight, temperatures of 20 C^{o} to 10 C^{o}, and times from about 10 minutes to 48 hours.

3. The method of claim 1, said crushed coals are at particle sizes up to 5 millimeters.

4. The method of claim 3, said crushed coals are at particle sizes up to 2 millimeters.