**BACKGROUND AND RESEARCH OBJECTIVES**

- **Background**
  A key parameter affecting the flow of gas in coal cleats is the wetting potential of gas/water. However, how wettability affects gas flow still needs further research.

- **Main objectives**
  - To build a LBM model to simulate bubble-water dynamics at pore scale;
  - To analyse the influences of wettability and capillary pressure on gas-water flow capacity at pore scale.

**METHODS**

The model is based on a free energy model proposed by Swift et al. in 1996.

**Main components of the model**

- The interface capturing equation:
  
  \[ g_i(x + e_i \delta t, t + \delta t) = g_i(x, t) + (1 - q) [g_i(x + e_i \delta t, t) + g_i(x, t)] + \Omega_i \]

- The momentum equation:
  
  \[ f_i(x + e_i \delta t, t + \delta t) = f_i(x, t) + \Omega_i \]

- To distinguish different points on the fluid/solid interaction

  ![Diagram](image1)

  20 kinds of point

- To deal with the corner points

  ![Diagram](image2)

**SIMULATION AND RESULTS**

- **Simulation**

  Fig. 5 Gas bubble flow through a narrow channel

  The drag force \( F \) is fixed.

  The contact angle is changed from 45° to 120°.

- **Results**

  The simulation results indicate that the wettability of water has significant impacts on the flow capacity of gas bubble. An increase of bubble velocity is observed when the surface changes from water wet to gas wet. The bubble flow process significantly influences the drainage of water and the further gas production.

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