

## Measurements of Gas-Liquid Relative Permeability of Queensland Coals

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### Abstract

The feature of water-gas two-phase flow through coal seams determines the water depletion and gas production associated in coal seam gas recovery. Therefore, coal relative permeability is crucial for studies of two-phase flow behaviour in coal, which is greatly influenced by water/gas saturation and coal ranks. In this study, a permeability model incorporated with cleat size distribution and cleat tortuosity was developed to predict the relative permeability of gas and water in coals. An unsteady-state method has been applied to investigate the relative permeability of gas and water in coal samples from Surat Basin through water replacement with gas. A series of relative permeability curves for selected coals have been obtained. The measured pore size distribution, porosity and irreducible water saturation percentage are used to correlate the permeability of gas and water with gas saturation by modelling.

### Rel-Perm measurement

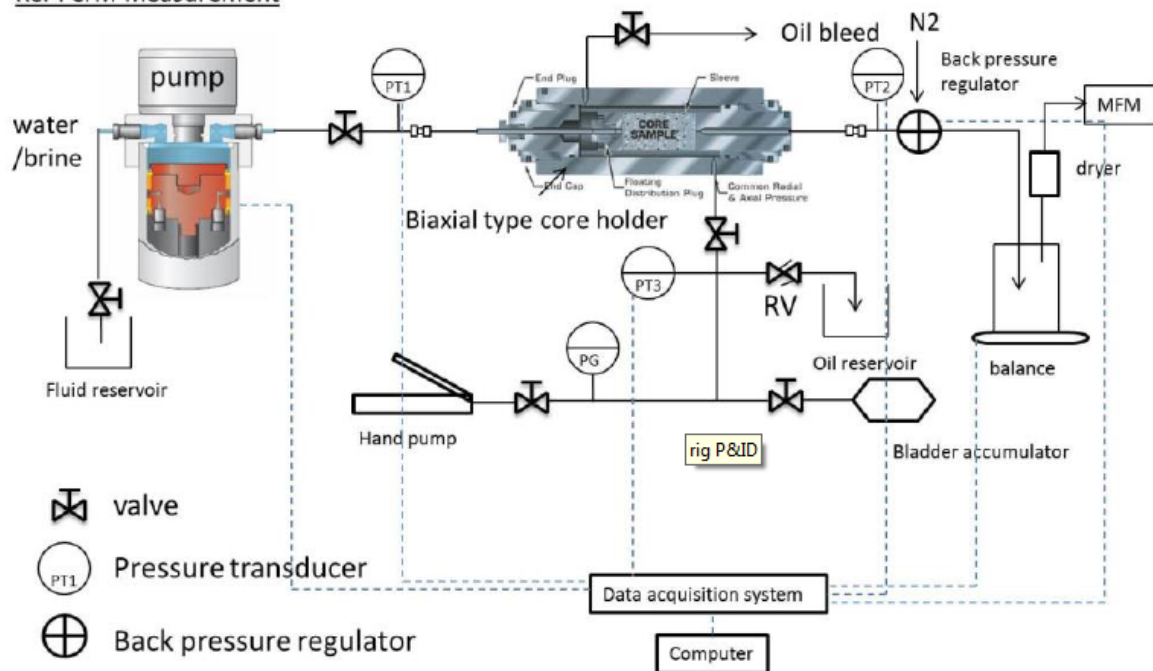
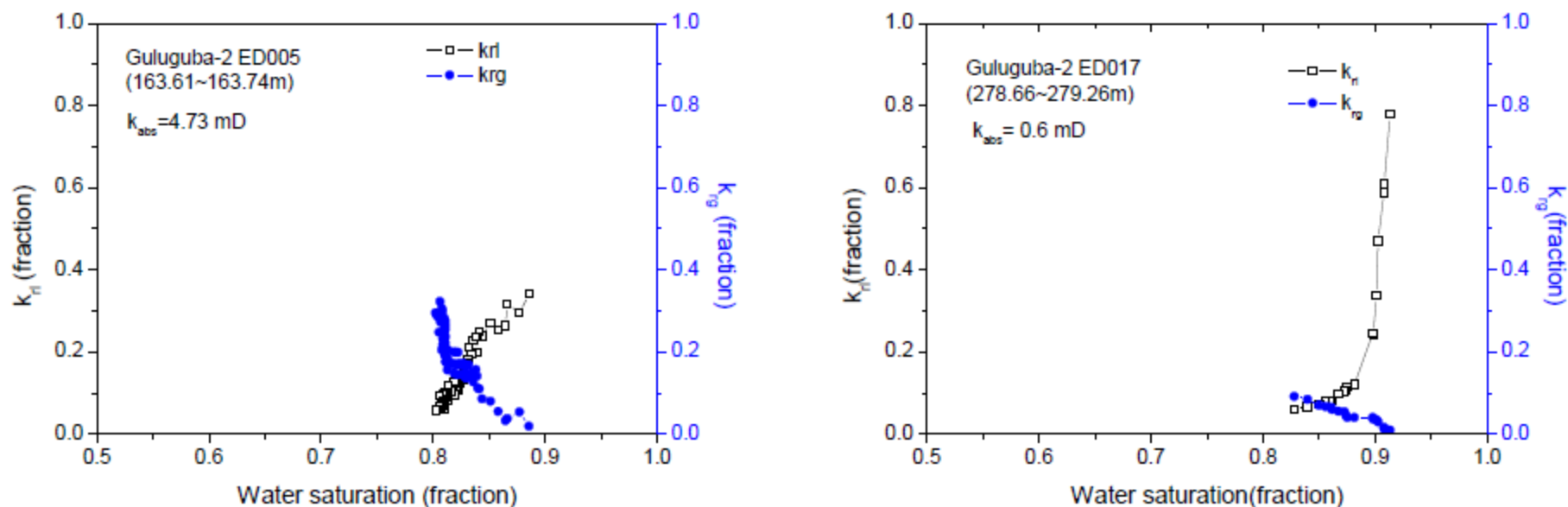


Figure 1. P&ID of relative permeability setup.

An unsteady-state core flooding experiment in which water is displaced from the coal by gas was used measure gas-water relative permeability and to determine capillary pressure in coals from the Surat Basin. The effects of effective stress, coal wettability and saturation on relative permeability will be investigated. Figure 1 provides the schematic of core flooding rig used to perform relative permeability measurements.



**Figure 2. Relative permeability curves for gas and water in Guluguba coals ED005 and ED017.**

ED005 exhibited a higher gas relative permeability due to its larger porosity and higher absolute permeability. The convex relative permeability curve of ED017 suggests that gas flow is not only through the main cleat pathways. The next phases of this project will investigate and validate new models including coal wettability and pore structure information (size distribution and tortuosity), to describe the gas-water behaviour in coal cleat networks.