

## List of symbols – Part 1

$\Delta P = P_{UP} - P_{DOWN}$ , pore pressure difference (Pa)

$\mu$ , dynamic viscosity (Pa.s)

$A$ , sample cross-sectional area (m<sup>2</sup>)

$b$ , Klinkenberg slip factor (Pa)

BIB-SEM, broad ion beam – scanning electron microscopy

$C_f$ , pore fluid compressibility (Pa<sup>-1</sup>)

$C_p$ , pore compressibility in response to pore pressure changes (Pa<sup>-1</sup>)

$D_m$ , gas molecule diameter (m)

FEDEX, Full-scale Engineered Barrier EXperiment

$G$ , gain, downstream to upstream wave amplitude ratio

GTS, Grimsel Test Site

$k$ , permeability (m<sup>2</sup>)

$k_{\infty}$ , permeability at infinite mean pore pressure in Klinkenberg's relationship (m<sup>2</sup>)

$k_{app}=k_{gas}$ , apparent permeability measured with gas (m<sup>2</sup>)

$k_{SST}$ , permeability measured with the steady-state method (m<sup>2</sup>)

$k_{PLS}$ , permeability measured with the transient pulse method (m<sup>2</sup>)

$k_{OSC}$ , permeability measured with the oscillating pore pressure method (m<sup>2</sup>)

KG<sup>2</sup>B, K for Grimsel granodiorite benchmark

$K_n$ , Knudsen number

$k_o$ , permeability at zero effective pressure (m<sup>2</sup>)

$L$ , sample length (m)

MICP, mercury injection capillary pressure

$N_A$ , Avogadro's number

$P_\infty$ , pressure at infinite time in pulse test (Pa)

$P_{ATM}$ , atmospheric pressure (Pa)

$P_c$ , confining pressure (Pa)

$P_{DOWN}$ , downstream pore pressure (Pa)

$P_{eff} = P_c - P_p$ , effective pressure (Pa)

$P_{MEAN}$ , mean pore pressure (Pa)

$P_p$ , pore pressure (Pa)

$P_{UP}$ , upstream pore pressure (Pa)

$Q = Q^V = dV_p / dt$ , volume flow rate (m<sup>3</sup>/s)

$Q^M = dM / dt$ , mass flow rate (kg/s)

$R$ , universal gas constant (J.mol<sup>-1</sup>.K<sup>-1</sup>)

REV, representative elementary volume

$H$ , hydrodynamic length scale taken as the average crack aperture  $r$  (m)

SAFOD, San Andreas Fault Observatory at Depth

$T$ , absolute temperature (K)

$t$ , time (s)

$V$ , gas volume (m<sup>3</sup>)

$V_{DOWN}$ , downstream tubing volume (m<sup>3</sup>)

$V_p$ , pore volume (m<sup>3</sup>)

$V_{UP}$ , upstream tubing volume (m<sup>3</sup>)

$Z$ , gas deviation factor

$\xi$ , dimensionless storativity ratio

$\alpha$ , decay factor in pulse test ( $s^{-1}$ )

$\beta$ , sample storativity ( $Pa^{-1}$ )

$\beta_D$ , downstream reservoir storage ( $m^3Pa^{-1}$ )

$\phi$ , porosity

$\gamma$ , permeability pressure dependence factor ( $Pa^{-1}$ )

$\eta$ , dimensionless permeability

$\lambda$ , mean free path of a gas molecule (m)

$\theta$ , phase shift between upstream and downstream waveforms (rad)

$\tau$ , period of oscillation (s)