



# Hydraulic fracturing design and 3D modeling: a case study from Cambay Shale and Eagleford Shale

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## Abstract

Economically producing oil and gas from low permeable unconventional shale gas reservoirs has been made possible by the implementation of hydraulic fracturing with horizontal drilling and microseismicity. This new technique can drastically transformed the energy future of India. Hydraulic fracturing improves well productivity and enhances the production from ultra-low permeable formations. An optimum fracture design can help in understanding the pressure distribution inside the fracture and the fracture geometry (length, width and height). The present study is an attempt to design a hydraulic fracture model for Cambay Shale in a 3D simulator to assess the application of this advance technology in clay-rich shale of India. It also follows in parallel, a fracture design and modeling of Eagleford Shale, USA. It was observed that Cambay Shale has less frac height and frac half-length as compared to Eagleford Shale due to clay richness of Cambay. A clay conditioner may be used before implementing the hydraulic fracturing job in shale sections of Cambay. This can help in attaining more fracture growth and propagation.

**Keywords** Hydraulic fracturing · Fracture geometry · Cambay Shale · Fracture propagation

## List of symbols

$q$	Injection flow rate	$\bar{\nabla} P$	Change in pressure
$\tau$	Time of fracture leakoff area creation	$\Theta$	Dimensionless time
$V_f$	Fracture volume	$\Phi$	Porosity
$V_l$	Fluid loss (no spurt loss)	$W$	Fracture width
$V_{sp}$	Volume loss by spurt	$f$	Darcy friction factor
$t$	time	$Re$	Reynolds Number
$C$	Total leakoff coefficient	$\rho$	Density
$A$	Leakoff area (one face of the fracture)	$\varepsilon$	Relative wall roughness
$S_p$	Spurt loss coefficient	$\Gamma_w$	Generalized influence function
$\alpha_a$	Leakoff area parameter	$H_\xi$	Characteristic half height
$\alpha_c$	Leakoff parameter during pumping	$G(\Theta)$	Fluid loss function
$\alpha_{c2}$	Reservoir compressibility and viscosity coefficient	$\Delta P$	Is the net fracture pressure $P - \sigma$
$\alpha \tau$	Leak off parameter at the time of fracture	$K_{IC}$	Critical stress intensity factor
$t_p$	Pumping time	$\Pi$	Pie (3.14)
		$x$	Lateral coordinate along fracture length
		$y$	Coordinate perpendicular to frac face
		$z$	Vertical coordinate
		$G$	Shear modulus
		$\nu$	Poisson's ratio

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