Hydraulic Fracture Permeability @model

One of the models of Hydraulic Fracture Permeability is based on Cozeny-Karman permeability @model:

(1) $k_f = 1014.24 \cdot \mathrm{FZI}^2 \cdot \frac{(\phi_f - \phi_{f0})^3}{(1 - \phi_f + \phi_{f0})^2}$	(2) $\mathrm{FZI} = \frac{1}{\sqrt{F_S} \, S_{gV} \, \tau}$

where

FZI	Flow Zone Indicator	$S_{gV} = \Sigma_e / V_\phi$	surface pore area per unit pore volume	Σ_e	pore surface area
ϕ_f	fracture porosity	F_S	pore shape factor	V_ϕ	pore volume
ϕ_{f0}	porosity cut-off	τ	pore channel tortuosity		

In case of proppant-filled fracture the Flow Zone Indicator can be approximated as:

(3) $$\mathrm{FZI} \approx 0.0037 \cdot \frac{d_p}{\tau_p}$$

where

d_p	proppant average grain size
τ_p	fracture pore channel tortuosity

For the fluid-filled fracture ($\phi_f = 1$) the fracture permeability has a simple correlation:

(4) $$k_f = \frac{w_f^2}{12}$$

In Well Testing applications it normally behaves as the infinite-value fracture permeability due to a high contrast with typical formation permeability.

It can be formally interpreted as the extreme case of finite-conductivity fracture with the following trends:

(5) $\mathrm{FZI} \rightarrow \frac{w_f}{2\sqrt{F_S}}$	(6) $F_S \rightarrow 253.56 \, \frac{\phi_{f0}^2}{(1 - \phi_{f0})^3}$

but this has little practial value.

See Also

Petroleum Industry / Upstream / Well / Well-Reservoir Contact (WRC) / Hydraulic Fracture