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THEORY AND RESEARCH BACKGROUND

Simulations on foam displacement are studied... something about STARS, about previous work of Namdar Zanganeh, Kam and Ade.

For the simulations of foam displacement the STARS^{TM} is used. The effect of water and oil saturation are both taken into account 2.1.

Without oil present, foam can reduce gas mobility enormously, oil however can weaken or destroy foam.

2.1. FOAM MODELLING IN STARS^{TM}

With the presence of foam, gas mobility is greatly reduced Prud'homme and Khan [2, Ch.11], this is modelled by use of the STARS^{TM} model (Cheng et al. 2000; Computer Modelling group, 2006).
The gas relative permeability is modified for the effect of foam, this is done by a multiplication by a factor FM.

$$k_g^f = k_{rg}^0(S_w, S_o) \cdot FM \tag{2.1}$$

$$FM = \frac{1}{(1 + fmmobF_1F_2F_3F_4F_5F_6fdry)} \tag{2.2}$$

For simplicity here several terms in the STARS model will be ignored, such as the effect of changing surfactant concentration. The foam mobility reduction factor, fmmob, is set to 55000. This value is modified by factors accounting for the effect of water saturation and the presence of oil.

$$FM = \frac{1}{1 + fmmobF_o fdry} \tag{2.3}$$

The parameters in the equation for FM are stated below:
Fw or fdry accounts for the effect of gas mobility as water saturation decreases to fmdry.

$$fdry = 0.5 + \frac{\arctan[epdry(S_w - fmdry)]}{\pi} \tag{2.4}$$

$$F_o = (\frac{fmoil - oilsaturation}{fmoil - floil})^{epoil} \tag{2.5}$$

The different parameters in the STARS^{TM} model will be explained for better understanding of the model

Parameter	Explanation
epdry	The greater this parameter the more abrupt the fall of $f_w(S_w)$ curve. Meaning a sharper, yet still continous, transition between the two regimes.
fdry	Controls the rise of gas mobility by taking into account the effect of water saturation.
floil	Lower oil saturation
fmdry	When the transition between the regimes is abrupt, *fmdry* will be the critical water saturation, S_w*, at which foam collapses.
fmmob	Reference mobility reduction factor
fmoil	Critical oil saturation