Parameters optimization of hydraulic fracturing for improving fracture complexity in shale reservoirs

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Abstract: Successfully creating a large field fracture network is crucial for exploiting unconventional reservoirs. In this paper, the variations of stress contrast and the fracture network are studied using a fully coupled flow and mechanics model. By mapping the distribution of in-situ stress during fracturing process, the fracture network area is calculated that is the extent of low in-situ stress contrast zones. The fracture spacing that avoiding sand plug and creating large field of fracture network is optimal. Optimal spacing decreases with in-situ stress contrast, and is not sensitive to varying Young's modulus of the shale matrix. High injection rate stimulation technique is found to be an effective method for improving the fracture complexity of horizontal well. Sensitivity studies are presented for the stimulation method in improving s fracture complexity. Initial in situ stress contrast plays a significant role in the creation of fracture network. The fracture width and stress perturbation is governed by the minimum in situ stress. The stress perturbation is accentuated in low permeability reservoirs, which facilities to achieve a large field of fracture network. The results presented in this paper can be used in hydraulic fracturing design in shale reservoirs to promote productivity.

Keywords: shale reservoirs, fracture network, hydraulic fracturing, fracture spacing, injection rate