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Liquid-Liquid Gravity Displacement Test Based on Experimental Apparatus for Real Fractures

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ABSTRACT

In order to understand the actual flow pattern of fluids inside fractures during liquid-liquid displacement,visualized displacement tests for drilling fluid and simulated formation fluid were conducted with a visualized apparatus for wellbore-formation coupled flow based on the liquid-liquid gravity displacement mechanism of fractured formations.This apparatus could simulate real fracture space by reference to fractures scanned in field outcrops.The affecting rules of fracture width,wellhead back pressure,density of drilling fluid,viscosity of drilling fluid and viscosity of formation fluid on the liquid-liquid displacement amount in volume-constant formations were analyzed,and further the relationships among the displacement amount and all influential factors were regressed on the basis of the dimension analysis theory.The results indicated that with the increase of fracture width,wellhead back pressure and density of drilling fluid,the displacement rate and amount would be increased;while with the increase of viscosity of drilling fluid and formation fluid,the displacement rate and amount would be reduced;under the same equivalent circulating density,drilling fluids with lower density and back pressure could produce less displacement amount.These results suggest that the pressure difference between the two ends of fractures is the key reason for the displacement,which can be traced to the differences between drilling fluid and formation fluid in density and viscosity.The research results can provide guidance for the control of liquid-liquid gravity displacement in fractured formations.