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Optimization of Acid Treatments by Assessing Diversion Strategies in Carbonate and Sandstone Formations

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Abstract : When acid is pumped into damaged reservoirs for damage removal/stimulation, distorted inflow of acid into the formation occurs caused by acid preferentially traveling into highly permeable regions over low permeable regions, or (in general) into the path of least resistance. This can lead to poor zonal coverage and hence warrants diversion to carry out an effective placement of acid. Diversion is desirably a reversible technique of temporarily reducing the permeability of high perm zones, thereby forcing the acid into lower perm zones. The uniqueness of each reservoir can pose several challenges to engineers attempting to devise optimum and effective diversion strategies. Diversion techniques include mechanical placement and/or chemical diversion of treatment fluids, further sub-classified into ball sealers, bridge plugs, packers, particulate diverters, viscous gels, crosslinked gels, relative permeability modifiers (RPMs), foams, and/or the use of placement techniques, such as coiled tubing (CT) and the maximum pressure difference and injection rate (MAPDIR) methodology. It is not always realized that the effectiveness of diverters greatly depends on reservoir properties, such as formation type, temperature, reservoir permeability, heterogeneity, and physical well characteristics (e.g., completion type, well deviation, length of treatment interval, multiple intervals, etc.). This paper reviews the mechanisms by which each variety of diverter functions and discusses the effect of various reservoir properties on the efficiency of diversion techniques. Guidelines are recommended to help enhance productivity from zones of interest by choosing the best methods of diversion while pumping an optimized amount of treatment fluid. The success of an overall acid treatment often depends on the effectiveness of the diverting agents.

Keywords : diversion, reservoir, zonal coverage, carbonate, sandstone
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