A preliminary investigation of natural gas combustion as applied to thermal recovery of petroleum

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Abstract

"Present application of the subsurface combustion processes in the thermal recovery of petroleum afford favorable and opportune methods of providing greater recoveries from petroleum reservoirs. This study attempts to elucidate some of the parameters controlling the complex hydrocarbon oxidation for one such process. The experimental phase consisted of investigating the combustion behavior of eight nonexplosive and one explosive natural gas-air mixtures at low and intermediate pressures. The hydrocarbon was allowed to oxidize by self-ignition under controlled conditions within environments precluding a visible flame type reaction. Progress of the reaction was followed by measuring effluent oxygen content. Experimental evidence indicate the combustion reactions were inhibited by packing and varying degrees of reaction completion could be obtained through variation of controlling parameters. Effects of increasing reactor pressure permitted a lower oxidation temperature. Initial oxidation temperatures were found to vary from 950 °F at atmospheric pressure to approximately 470 °F at 27.65 atmospheres absolute pressure. Although data obtained experimentally are not sufficient to permit a rigorous interpretation, nevertheless a qualitative interpretation of parameters controlling natural gas combustion in a porous now system has been presented"--Introduction, page vi.

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Non-thermal secondary recovery methods. A lot of oil can be left behind after primary recovery, since the normal reservoir pressure has declined and as a result there is no natural force that can push the oil into the well that's why secondary methods come into play. Secondary oil recovery techniques are applied on depleted or low pressure reservoirs. The concept of injecting a solvent has been found promising for the recovery of heavy oil and bitumen. The Development of Thermal Recovery Methods Within Shell — A Synergetic Approach of Research and Field Operations Ft. Barthel, J. Offeringa, and J. Weijdema. Chapter 98. Trends and Some Results of Pilot Operations for the Recovery and Utilization of Bitumen in Tataria, U.S.S.R. G.M. Akchmadiev, R.N. Diyeshev, and R.H. Muslimov. Chapter 99. Numerical Modeling of Thermal Oil Recovery Processes from Artificially Fractured Reservoirs B.M. Geshelin, J.W. Grabowski, and E.C. Pease. Chapter 100. Paper 22 Co-agglomeration of Petroleum Cokes with Lime/Limestone Followed by Combustion in a Fluidized-bed Reactor. Paper 199 Heavy Oil Coke Utilization in the Aluminum Industry. Paper 208 The Use of Cuban Crude Oils as Industrial Fuel Oil. Gas processing plants are required for the recovery of liquefiable constituents and removal of hydrogen sulfide before the gas is used (see Section 5.3, Natural Gas Processing). gas-fired boilers (which result in characteristic changes in emission rates) are low NOx burners and flue gas recirculation. Low NOx burners reduce NOx by accomplishing the combustion process in stages. Other combustion staging techniques which have been applied to natural gas-fired boilers include low excess air, reduced air preheat, and staged combustion (e.g., burners-out-of-service and overfire air). 15. Field Investigation Of Emissions From Combustion Equipment For Space Heating, EPA-R2-73-084a, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1973.