
PAVEL ZENON SEJAS PAZ, University of Brasília

EM heating stimulated water flooding for medium-heavy oil recovery

We report a study of heavy oil recovery by combined water flooding and electromagnetic (EM) heating at a frequency of 2.54 GHz used in domestic microwave ovens. A mathematical model describing this process was developed. Model equations were solved and the solution is presented in an integral form for the one dimensional case. Experiments consisting of water injection into Bentheimer sandstone cores, either fully water-saturated or containing a model heavy oil, were also conducted, with and without EM heating.

Model prediction is found to be in rather good agreement with an experiments. EM energy was efficiently absorbed by water and, under dynamic conditions, was transported deep into the porous medium. The amount of EM energy absorbed increase with water saturation. Oil recovery by water flooding combined with EM heating was up to 37.0% larger than for cold water flooding. These observations indicate that EM heating induces an overall improvement of the mobility ratio between the displacing water and the displaced heavy oil.