Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Critical surface roughness for wall bounded flow of viscous fluids in an electric submersible pump DHAIRYASHEEL DESHMUKH, MD HAMID SIDDIQUE, Indian Inst of Tech-Madras, FRANK KENYERY, Simon Bolivar University, ABDUS SAMAD, Indian Inst of Tech-Madras — Surface roughness plays a vital role in the performance of an electric submersible pump (ESP). A 3-D numerical analysis has been carried out to find the roughness effect on ESP. The performance of pump for steady wall bounded turbulent flows is evaluated at different roughness values and compared with smooth surface considering a non-dimensional roughness factor K. The k- SST turbulence model with fine mesh at near wall region captures the rough wall effects accurately. Computational results are validated with experimental results of water (1 cP), at a design speed (3000 RPM). Maximum head is observed for a hydraulically smooth surface (K=0). When roughness factor is increased, the head decreases till critical roughness factor (K=0.1) due to frictional loss. Further increase in roughness factor (K¿0.1) increases the head due to near wall turbulence. The performance of ESP is analyzed for turbulent kinetic energy and eddy viscosity at different roughness values. The wall disturbance over the rough surface affects the pressure distribution and velocity field. The roughness effect is predominant for high viscosity oil (43cP) as compared to water. Moreover, the study at off-design conditions showed that Reynolds number influences the overall roughness effect.

Dhairyasheel Deshmukh
Indian Inst of Tech-Madras

Date submitted: 31 Jul 2017 Electronic form version 1.4