

Swell Packers and Expandable Tubulars in Petroleum Drilling — Finite Element Simulation

Sayyad Zahid Qamar[1], Maaz Akhtar[2], Tasneem Pervez[1]
[1]Mechanical & Industrial Engineering Department, Sultan Qaboos University, Muscat, Oman
[2]Mechanical Engineering Department, N.E.D. University of Engineering and Technology, Karachi, Pakistan

In solid expandable tubular (SET) technology, a conical mandrel is forced through a petroleum tubular to expand it to the desired diameter. SET applications in oil and gas wells, such as water shutoff and zonal isolation, employ swelling elastomers as a sealing material. These are innovative polymers with the unique capability of swelling when in contact with fluids like water, oil, or acid. During tubular expansion against rock formation, compression of the swelling elastomer elements against the formation provides the required sealing. This compression can be achieved through expansion of the inner tubular, by swelling of the elastomer element against the formation, or through a combination of the two. Before deployment of SET-based swell packers, it is important to assess their possible behavior under a given set of field conditions.

The current paper is part of the research work on expandable tubulars and swellable elastomers conducted at Sultan Qaboos University, Muscat, Oman. Results presented here are based on numerical simulation used to investigate the effect of various field conditions on the sealing or contact pressure generated between the elastomer element and the rock formation. These parameters include elastomer seal material, SET expansion ratio, elastomer compression ratio, formation type, seal length, seal thickness, and SET boundary conditions. No work of this nature is generally available in published literature, based on actual material behavior of expandable tubulars and swelling elastomers used in the petroleum development industry. Results of this work can be used by field engineers, application developers, and researchers for proper selection and design improvement of SET and swelling elastomer applications.

Keywords: Oil and gas, drilling and development, swelling elastomers, applications, numerical simulation, enhanced oil recovery

Biography

Dr Zahid Qamar, Sayyad is a Professor at the Mechanical and Industrial Engineering Department, Sultan Qaboos University (SQU), Muscat. He has over 30 years of academic, research, and technical experience in different international universities and as a professional mechanical engineer. His research areas are Applied materials and manufacturing, Applied mechanics and design, Reliability engineering, and Engineering education. With over 4 million USD in funded projects, he has over 200 publications to his credit: research monographs, one encyclopedia, edited books, chapters, papers in international journals and conferences, and technical reports. He has served as Associate editor, Guest editor, and Member editorial board for different research journals (including Materials and Manufacturing Processes, Journal of Elastomers and Plastics, Journal of Engineering Research, etc).

Presenting author details
Full name: Sayyad Zahid Qamar
Contact number: +968 92599727
Twitter account:
Linked In account: https://www.linkedin.com/in/sayyad-zahid-qamar-b84b9110/?originalSubdomain=om
Session name/ number:
Category: **Keynote address**; Oral presentation