

# Stimuli Responsive Polymers in Oil and Gas Industries

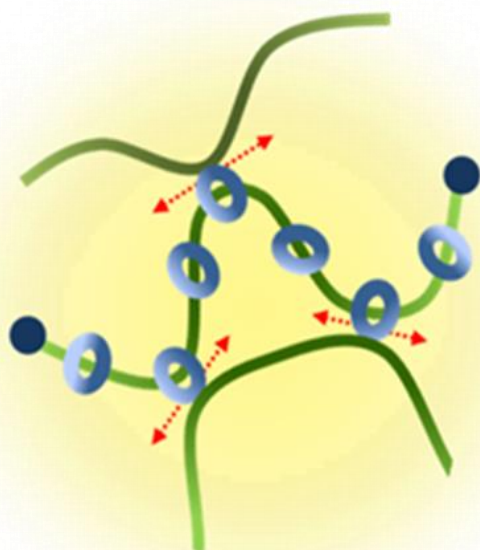
Hasmukh A. Patel

Aramco Americas: Aramco Research Center – Houston, 16300 Park Row Dr, Houston, TX 77084, United States

Corresponding and Presenting Author. E-mail: hasmukh.patel@aramcoamericas.com

DOI: 10.5185/vpoam.2021.02106

## Graphical Abstract



Stimuli responsive polymer –  
Polyrotaxanes: Pulley principle for stress  
distribution at molecular level



Neat Cement



Cement + 1% additive

## Abstract

Primary cementing is one of the most important operations executed on the well in the course of oil and gas well construction. The cement is placed in the annulus between the rock formations of the wellbore and casing, to provide zonal isolation. The quality of the cement job has a direct impact on the economic longevity of the well throughout the life of producing oil and gas. The failure in the cement is typically observed at two operational stages, [1] at the time of the placement of the cement — improper balancing of the pressures that allows gas and fluid influx into the cement-filled annulus and movement of pipes, and [2] during production, uneven distribution of forces on the cement

sheath, generated from the pressure difference. The present research focuses on addressing the uniform distribution of forces exerted in the course of production on the cement sheath. A novel polymeric additive — stimuli responsive polymer — that facilitate molecular motions at sub-nanometer level in the cement sheath have demonstrated exceptional improvement in the mechanical properties of the cement. Sliding motions of the chemical constituents in the polymeric additive allow rearrangement of the network structure and thus it contribute toward resistance from the long-term stress-strain cycles. Stimuli responsive polymer has transformed brittle cement into tough cement without compromising compressive strength.

**Keywords:** Stimuli responsive polymers; polyrotaxanes; cement; oil and gas well construction.

## Biography of Presenting Author



**Hasmukh Patel** is a Senior Research Scientist in Drilling Technology Team of the Aramco Americas: Aramco Research Center–Houston, United States. Prior to joining Aramco, He has worked as postdoctoral fellow with Professor Fraser Stoddart (2016 Nobel Laureate in Chemistry) at Northwestern University, USA. He has also carried out his research at Politecnico Di Torino - Italy, Korea Advanced Institute of Science and Technology - South Korea, and University College London - United Kingdom. He has been working in the field of developing novel materials for energy and environment applications. He holds a Ph.D. in Chemistry from CSIR-CSMCRI, India. He has published more than 50 research articles in

peer-review journals, penned a book and a book chapter, and contributed 16 patents. His research articles have been garnered more than 3,200 citations.

## Citation of Video Article

Vid. Proc. Adv. Mater., Volume 2, Article ID 2102106 (2021)

**Full Video Article** [www.proceedings.iaamonline.org/article/vpoam-2021-02106](http://www.proceedings.iaamonline.org/article/vpoam-2021-02106)