Please fill in the name of the event you are preparing this manuscript for.	2020 International Petroleum Technology Conference
Please fill in your 5-digit IPTC manuscript number.	20IPTC-20252-Abstract
Please fill in your manuscript title.	Original Abstract

Please fill in your author name(s) and company affiliation.

Given Name	Surname	Company
John	Yang	Aramco Overseas Company
Daniel	Harrigan	Aramco Overseas Company
Michele	Ostraat	Aramco Overseas Company
Sebastien	Duval	Saudi Aramco
Milind	Vaidya	Saudi Aramco
Ahmad Abdallah	Bahamdan	Saudi Aramco

Abstract

Objectives/Scope: The use of natural gas for power generation and seawater desalination, as well as for chemical feedstock, provides significant diversification in oil-producing countries. Commercially available siloxane membranes, e.g. polydimethylsiloxane (PDMS), separate heavy hydrocarbons (C3+), referred to as natural gas liquids (NGL), from natural gas using significantly less energy. These PDMS membranes exhibit lower C3+/C1 selectivities under harsh industrially relevant conditions. To enhanced separation performance, this talk will discuss strategies used to develop novel PDMS membrane materials for enhanced NGL recovery from natural gas.

Methods, Procedures, Process: We synthesized two series of novel PDMS membrane materials comprised of modified vinylmethylsiloxane terpolymers via an addition curing (platinum catalyzed hydrosilylation reaction) and grafting-hydrolysis-polycondensation (both platinum and acid catalyzed hydrosilylation reactions) process by controlling polymer backbone and side-chain structures, crosslinking moieties, and crosslinked networks in the membrane matrix. PDMS/polyacrylonitrile (PAN) thin film composite membranes were fabricated on the top of porous support. The structure- property relationships of these novel PDMS membrane materials were investigated using DSC, TGA, FTIR, and SEM.

Results, Observations, Conclusions: Results were complemented by permeation testing of pure and multicomponent mixtures under industrially relevant feed streams and testing conditions, including the use of C1-C5 hydrocarbons in the presence of N2, CO2, and aggressive BTEX contaminants at feed pressure up to 850 psi. These results demonstrate the strong dependence of C3+/C1 selectivity on feed compositions, operating parameters, and PDMS chemical structure. Under the harshest business case conditions, novel PDMS/PAN composite membranes consisting of octylmethylsiloxane as a backbone and diphenylsiloxane or phenylmethylsiloxane as a side-chain consistently showed superior NGL separation performance (30% and 87% increase in C3/C1 and C4/C1 selectivities) as compared to commercially available PDMS membranes at all conditions tested.

Novel/Additive Information: The results of this study aim to introduce a novel method for producing more efficient siloxane membrane materials with improved C3+/C1 selectivity compared to commercially available PDMS membranes. With this enhanced membrane performance, this PDMS/PAN composite membrane is potentially a promising candidate to achieve significant recovery of NGL from natural gas while reducing capital and operating expenditures.