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**High Pressure and Temperature Effects in Polymers** DAVID BUCKNALL, VALERIA ARRIGHI, KIM JOHNSTON, IAIN CONDIE, Heriot-Watt Univ — Elastomers are widely exploited as the basis for seals in gas and fluid pipelines. The underlying behaviour of these elastomer at the high pressure, elevated temperatures they experience in operation is poorly understood. Consequently, the duty cycle of these materials is often deliberately limited to a few hours, and in order to prevent failure, production is stopped in order to change the seals in critical joints. The result is significant time lost due to bringing down production to change the seals as well as knock on financial costs. In order to address the fundamental nature of the elastomers at their intended operating conditions, we are studying the gas permeation behaviour of hydrogenated natural butyl rubber (HNBR) and fluorinated elastomers (FKM) at a high pressure and elevated temperature. We have developed a pressure system that permits gas permeation studies at gas pressures of up to 5000 psi and operating temperatures up to 150C. In this paper, we will discuss the nature of the permeation behaviour at these extreme operating conditions, and how this relates to the changes in the polymer structure. We will also discuss the use of graphene-polymer thin layer coatings to modify the gas permeation behaviour of the elastomers.

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