Title: Identification of polyethylene degradation at high gas pressures using cross fractionation chromatography

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References:

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Reference 10:
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Abstract:

The solubility of gases in polyethylene is of great importance in the development of membranes, the separation and storage of gases, and the development of energy-efficient recycling methods [1,2,3]. The molecular architecture, and consequently the semi-crystalline structure of the polyethylene, strongly influences gas solubility. It is known that the solubility of the gases occurs predominantly in the amorphous regions of the polymer rather than in the crystalline domains. This leads to a heterogeneous solubility distribution in the polymer morphology and amorphous regions are driven to expand while crystalline domains act as internal constraints [4]. As a result, a heterogeneous distribution of mechanical stresses, i.e. eigenstresses, is developing, shown in [4]. In this work, we systematically analyse, how specific gases at high pressure and under certain temperatures induce changes to the molecular architecture and hence also to the polyethylene morphology. Therefore, HDPE is pressurized with inert gases at several temperatures until the gas solubility equilibrium in the polymer has occurred. The changes in the molecular architecture of the polyethylene are determined based on cross-fractionation chromatography (TREFxSEC), and the morphological changes are determined by high-resolution DSC and XRD. It will be shown, that gas pressure-induced architecture and morphology changes should be clarified in detail, such that rather validated gas solubility data can be obtained and allocated to respective architecture and morphology.