

Polyolefin Pipes with Barrier Layer for Crude Oil Applications

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Our research deals with polymer pipes for crude oil applications especially with the development of methods to detect the permeation of crude oil, the increase of the thermal stability of polymer pipes and the decrease of permeation by using barrier layer. High density polyethylene (HDPE) has been the preferred material for lining applications for crude-oil onshore and inland transport at higher temperature and pressure. The material shows a high chemical resistance to various metal-aggressive substances in the oil. However, one special aspect for materials in onshore pipe oilfield applications is the requirement of a high permeation resistance against low molecular weight hydrocarbons. It is known that polyethylene (PE) pipes have high permeation rates for hydrocarbons, but no investigations with crude oil exist. Therefore, the permeation process of low-molecular-weight hydrocarbons through PE pipes was investigated by gravimetric analysis. This method is limited because the permeation of one component of crude oil cannot be measured. To bypass limitation of the gravimetric method a new method based on GC-MS techniques was developed. Based on this new method the permeation rate of single solvents from crude oil was detected and calculated. Permeation data are also compared to crosslinked PE pipes because crosslinked pipes have higher thermal stability. The crosslinking process of PE was tested and optimized related to the permeation behavior.

Much attention has been paid to polymers to use them as barrier system for hydrocarbons. Therefore, several barrier materials were designed based on polyvinylalcohol (PVA) because PVA is water soluble and may be considered environmentally benign. For the use of PVA as barrier material, it is necessary to crosslink the PVA. An active filler and PVA were combined to a composite material. The active filler has azosulfonate group on the surface and can be used as photo initiator for crosslinking of PVA. The coating technique was developed because this process strongly influences the permeation properties of PE-PVA-layers. Summarized, it was proved that such barrier layers are effective and prevent the permeation of hydrocarbon through PE pipes.

Biography:

Gisbert Riess has finished his study of chemistry in 1990 with the diploma thesis (Arylazosulfonates and their Reactions) at the University of Bayreuth. Afterwards he started his PhD thesis in polymer chemistry dealing with Novel Blockcopolymers via Cationic Polymerisation. In 1993 he got his PhD at the University of Bayreuth. Until 2001 he was senior researcher at the university of Bayreuth and Munich. Since 2001 he is head of a workgroup in polymer engineering and science at the University of Leoben. His research interests are surface functionalization of fillers, barrier layer for polymers and foam materials.