GRP Pipeline Retrofitting for Methanol Transport

Introduction

In the (petro) chemical industry, glass reinforced vinylester and epoxy resins are often used as a construction material for pipelines, tanks and processing equipment. When there is a demand for resistance to acidic or alkaline liquids, vinylester resins are particularly useful.

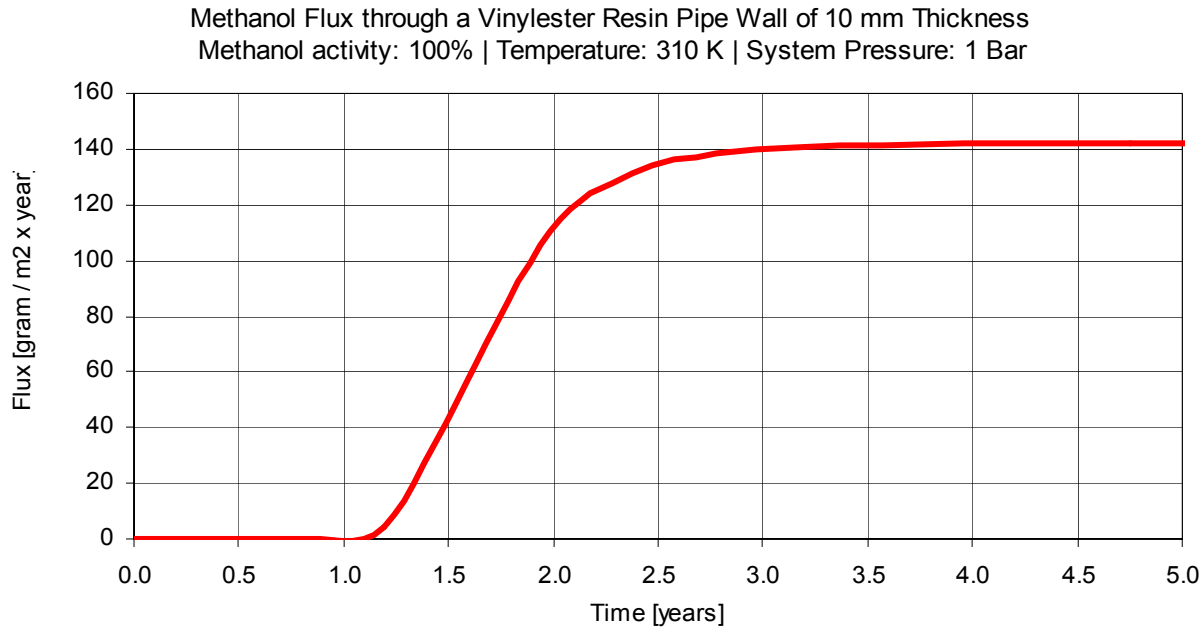
Suppose that we have a vinylester resin pipeline. In the past, the pipe was used for the transport of alkaline water. Diffusion Polymers is commissioned to assess whether it is possible to use the pipeline for the transport of methanol in the near future. Apart from the effect of alkaline water on sustainability of the pipeline, we want to know the loss of methanol from the pipeline into the atmosphere in the future situation. In our calculations we assume that the pipeline is internally continuously exposed to methanol. By use of our experimental key figures and chemical-physical simulation programmes, we are able to include swelling behaviour and possible chemical degradation during methanol diffusion.

Graphical Analysis

The process conditions are given:
- Pressure: 1 Bar
- Temperature: 37 degrees Celsius
- Activity of methanol: 1 (continuously loaded)

The diffusion properties that were obtained:
- Methanol solubility: 0.16 m^3 methanol / m^3 vinylester
- Diffusion coefficient at zero methanol concentration (D_0): 4 10^{-14} m^2/s
- Weighted average methanol diffusion coefficient (D|): 5 10^{-13} m^2/s

On the next page, the mass transfer or – so called – flux is depicted as a function of time.



Explanation

Because of diffusion time lag, there is no significant loss of methanol from the pipeline during the first year. On the other hand, the resin swells considerably: on the exposure side around 13 volume percent. Therefore the diffusion front reaches relatively fast a stationary condition: after 3 years. In this situation the steady loss is 140 gram per square meter per year.

Although that the polymer swells, which reduces the mechanical performance, it is not expected that substantial chemical degradation will occur within the first 5 years.