SUBSEAPIPE – Cementitious cork composites for improved thermal performance of pipelines for ultradeep waters

Summary

The main goal of the project was to develop a cementitious cork composite with the aim of improving thermal and mechanical performance in pipelines for oil exploration.

Scope

Most oil companies have shown interest in extracting oil and gas from deep and ultra-deep waters. Explorations off the coast of Brazil are being recognized at an international level, due to both the continuous discovery of new oil fields and the technological experience accumulated throughout the country. Besides the known problems related to drilling in the pre-salt fields, at more than 300 km from the shore and at depths over 2.5 km, there are new challenges related to the transport of oil and gas to shore. In such environments, the pipelines are required to have adequate thermal insulation. However, this must not compromise the oil flow, or complicate the operation and installation procedures.

Main objectives

To develop and optimize a new flexible cementitious composite integrating cork granulates that ensures good structural and thermal behaviour of sandwich pipelines for the transportation of oil and gas from deep waters.

Project activities

The project investigated all aspects involved, from material selection and composite development to the structural and thermodynamic behaviour of pipelines. The thermomechanical properties of the pipeline and the composite, as well as the durability of the composite, were studied experimentally. Additionally, numerical simulations of the structural behaviour and the heat transfer through and along the pipeline were performed. The result of the project was the optimization of a new flexible cementitious composite integrating cork granulates that ensures good structural and thermal behaviour of sandwich pipelines for the transportation of oil and gas from deep waters.

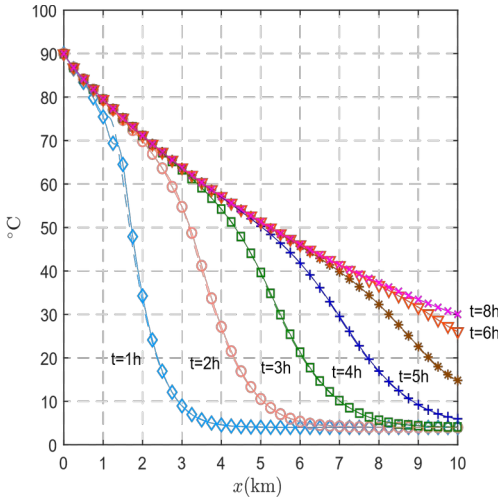

Figure 1. Convergence behaviour of the time-dependent bulk temperature distributions T (z, t) along the length of the pipeline without active electrical heating, at different time instants for the fine mesh (M = 5 ×2000) and the time step values Δt = 50 . 0 s (marked line) and Δt = 100 . 0 s (dashed line).

Figure 2. Tensile strength test.

CERIS : Civil Engineering Research and Innovation for Sustainability

Project Reference

POCI-01-0145-FEDER-032108 / PTDC/ECI-CON/32108/2017

Leading Institution

Itecons – Instituto de Investigação e Desenvolvimento Tecnológico para a Construção, Energia, Ambiente e Sustentabilidade (Portugal)

Partners

IST-ID – Associação do Instituto Superior Técnico para a Investigação e Desenvolvimento (Portugal)

CERIS Principal Investigator

Julieta António (julieta@itecons.uc.pt)

CERIS Research Team

António Tadeu, Gina Matias, Nuno Simões, Michael Brett, Miguel Esteves

Funding

COMPETE 2020, Portugal 2020, FCT – Fundação para a Ciência e a Tecnologia

Period

2018-2022

Total

239 896.18€

CERIS

Coimbra Hub: 140 785.26€

Project Website

https://www.itecons.uc.pt/services/projects/85