HYDROGEN EMBRITTLEMENT IN TRANSITIONAL APPROACH BY USING H_2/CH_4 BLENDING TO ADDRESS A LOW-CARBON ENERGY FUTURE

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The ongoing and accelerating global energy transition is driven by a confluence of environmental, economic, and societal imperatives. The energy transition is not merely a choice but a global need to address climate change, ensure energy security, foster economic growth, promote social equity, and embrace technological innovation according to the Paris Agreement.

In such a context, the hydrogen has emerged as a promising solution to reconcile the demand for energy guaranteeing environmental sustainability. However, the widespread adoption of pure hydrogen faces challenges related to infrastructure, storage, and cost. H_2/CH_4 blending represents a transitional step towards a low-carbon energy future. This transitional approach allows for the utilization of existing natural gas infrastructure, minimizing the need for costly and extensive modifications. The compatibility of blended gas with existing appliances, pipelines, and combustion systems is a crucial consideration for a seamless transition. Hydrogen embrittlement is a phenomenon that significantly impacts the structural integrity of materials, particularly metals, due to the ingress of hydrogen atoms. This process can result in a notable degradation of mechanical properties, including reduced ductility, lower yield strength, and diminished tensile strength. The consequences of hydrogen embrittlement are particularly concerning, as they can lead to unexpected and catastrophic failures in structures and components.

The study is conducted within the project BRIC 2022 RESET. The aim of the work is to study the influence of H_2/CH_4 ratio on the steel pipelines mechanical integrity, by means of an in-situ test setup in high-pressure gaseous environment. The studied H_2/CH_4 ratios will be 5, 10 and 15 % in volume, to meet industrial demands.