Arculus Solutions, Inc.

Future-proofing pipelines to safely transport hydrogen

Sector	Stage of Development	Major Goal
Hydrogen	TRL 4	Enable safe hydrogen transportation

The problem

In the US, we have a fully-developed natural gas grid with over **320,000 miles of transmission pipes** (used for high pressure transportation, with pipe diameters ranging between 12” and 48”).

The EPA published (1) that in 2021 the **CO2 emissions from natural gas** combustion in the US, as we burn an average of 32.31 trillion cubic feet per year (2), were **1,621.0 MMT CO2e** (MMT = million metric ton).

When burning natural gas (mostly composed of methane), you directly produce CO2.

When burning hydrogen, you produce water vapor.

Mixing hydrogen into natural gas pipelines allows for a direct reduction of the CO2 produced proportional to the amount of hydrogen in the mix.

Unfortunately, **we cannot mix hydrogen in the current pipeline condition because hydrogen would embrittle the steel**, causing higher leak rates or even possible catastrophic failures.

Our innovation

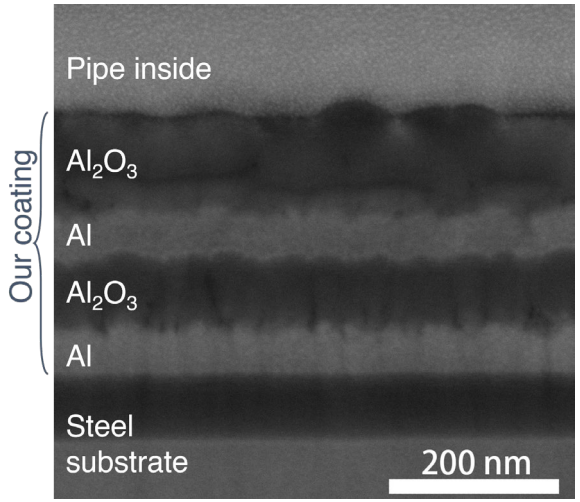
We developed a “hydrogen-barrier” coating that prevents the hydrogen from reaching the steel, those preventing hydrogen embrittlement.

The science behind our coating:

I. The formation of **extended space-charge zones** at the oxide/metal interface **repels hydrogen**.

II. The metallic adhesion layer ensures **physical and mechanical compatibility** with the pipe.

III. The **self-healing potential** preserves the **hydrogen-barrier performance even after damage**.



How to implement it

We are currently developing a **pipe-coating robot** that travels inside natural gas transmission pipelines and **applies our patented hydrogen-barrier coating**.

This will enable **future mixing of hydrogen** into natural gas pipelines at any percentage, **from 0% to pure hydrogen**, allowing to reuse current infrastructure without causing embrittlement in the steel, and avoiding expensive, unnecessary replacements.