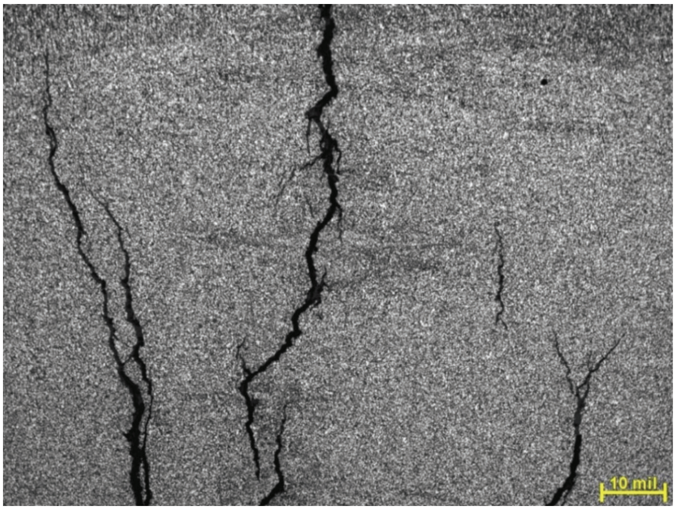

FIGURE 2 Colony of transgranular branched cracks emanation from the pipe ID.

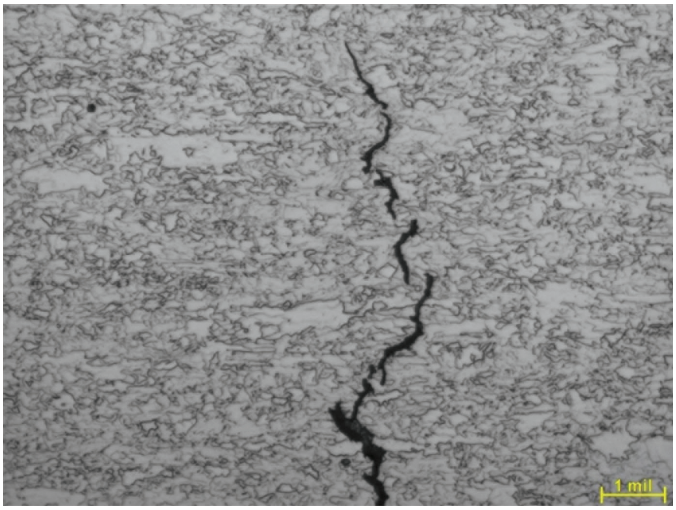

FIGURE 3 Discontinuous intergranular and some transgranular cracking ahead of the primary cracks.

of water, allowing $FeCO_3$ to precipitate and thereby establishing the conditions for SCC. This same effect of small solution volume to metal surface area ratio was also found by Craig et. al.[14] for CO_2 SCC of higher-strength steels. The important point from these cited references is the small amount of water confined to a small space needed to initiate SCC.

This same confined space is also observed in external NN pH SCC under coatings that have disbonded from the pipe wall. It is important to emphasize that wet SC-CO_2 transported in steel pipelines is not expected to be at risk of this form of cracking since the very low pH of water associated with large volumes of CO_2 will produce high corrosion rates that preclude the form of SCC found here.

Conclusions

The results of an investigation into the internal cracking of gathering lines transporting wet SC-CO_2 indicate the most likely mechanism for cracking is from NN pH SCC, which has not been previously identified inside of steel gathering pipe. There is apparently a necessary condition of confined spaces such as occur in lined pipe with a small annulus in order for cracking to initiate. These results should be considered speculative at this time and warrant further work to confirm the cracking mechanism. The finding from this investigation is important as it relates to future carbon capture and storage and carbon capture utilization and storage projects that may entail the use of lined pipe to transport wet SC-CO_2.

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