



Yizhi Hong¹, Hao Chen¹, Brian Harding¹, Ben Zoghi², M. Sam Mannan^{1,*} 1. Mary Kay O'Connor Process Safety Center, Department of Chemical Engineering, Texas A&M University *Phone: (979) 862-3985, e-mail: mannan@tamu.edu, URL: http://process-safety.tamu.edu 2. RFID Technology Center, Department of Engineering Technology and Industrial Distribution, Texas A&M University

Main Objective

This project was awarded to Mary Kay O'Connor Process Safety Center to develop an economic, universal, non-intrusive, continuous, real-time wireless monitoring system to simplify the corrosion inspection process, improve the accuracy and effectiveness of the resources, and enhance the overall safety performance of pipeline systems.

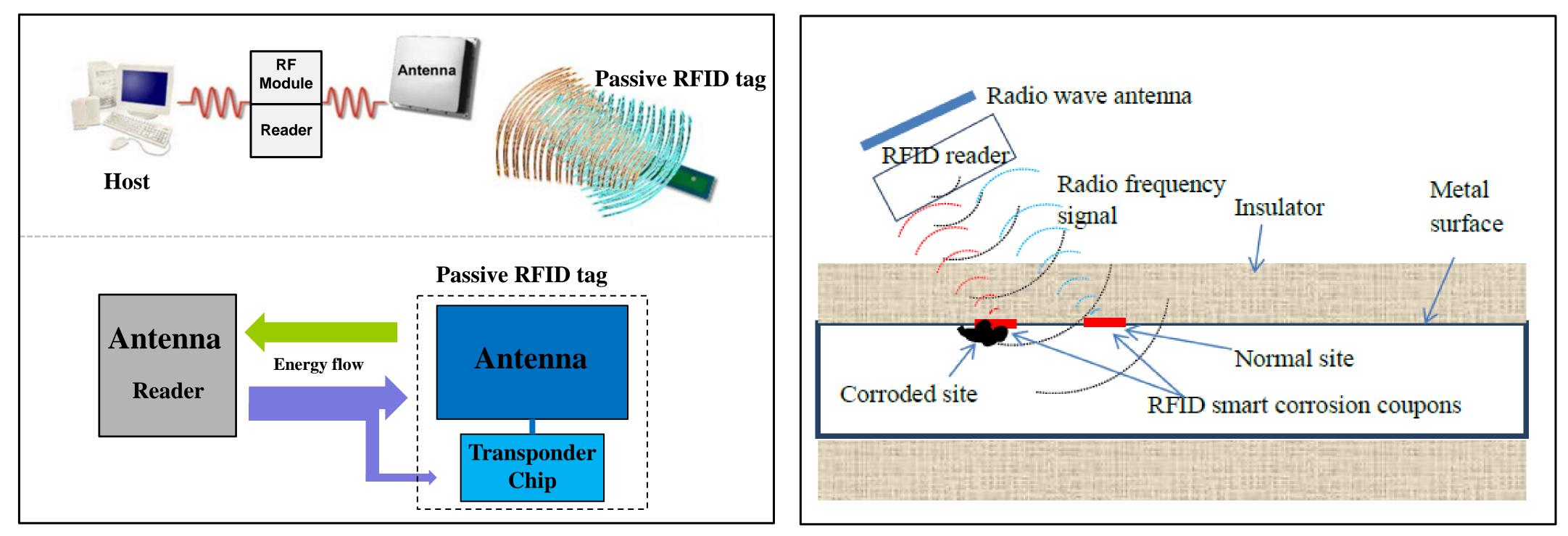


Figure 1. Schematic diagram of the working mechanism of a passive RFID tag

Project Approach/Scope

- RFID smart corrosion coupon design
- > Explore potential applications for areas susceptible to corrosion
- > Design laboratory corrosion testing methodology
 - Validation of RFID corrosion coupon
 - **Corrosion rate tests**
 - Well controlled corrosion process in a corrosion testing chamber

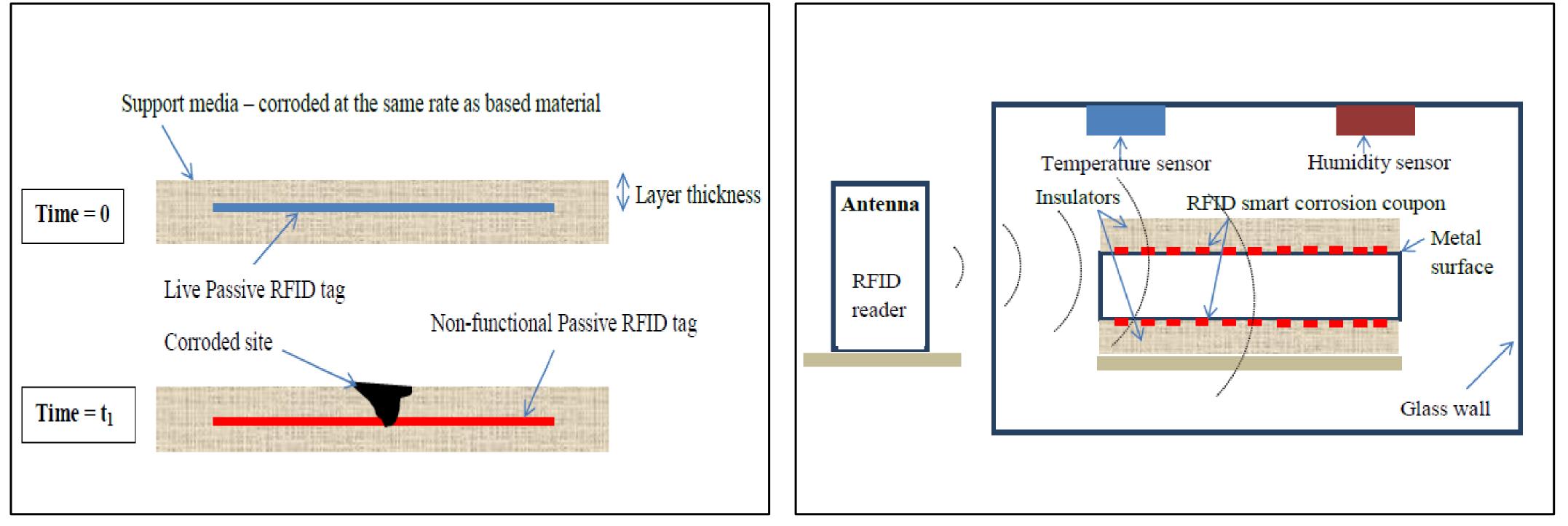


Figure 3. ON-OFF single layer RFID corrosion coupon

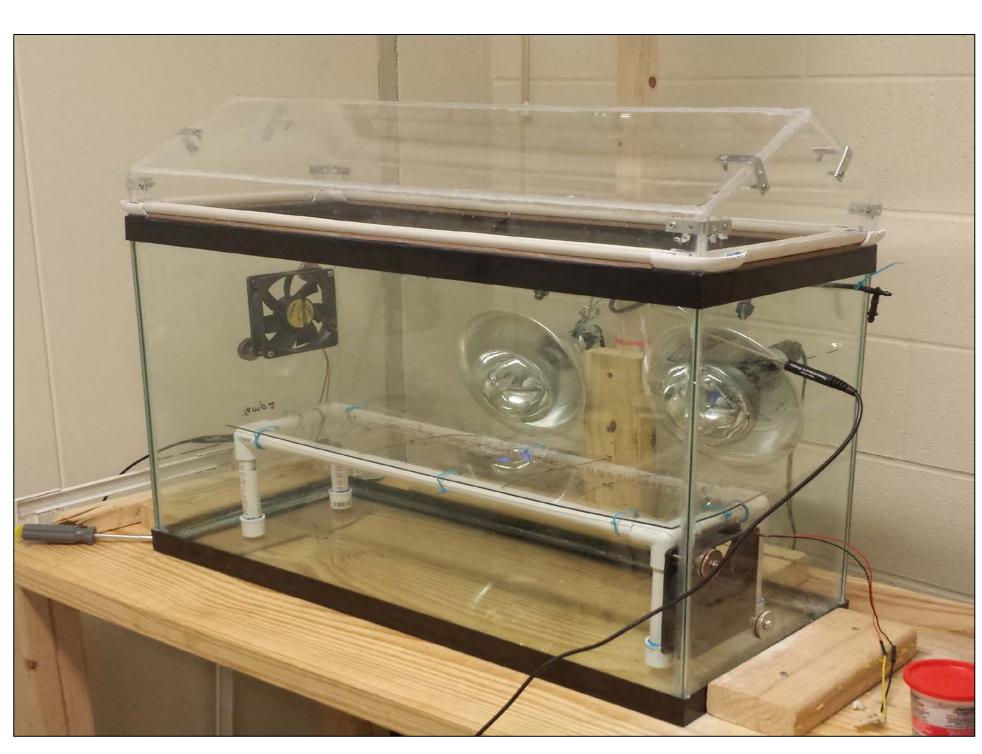
Radio frequency identification (RFID) smart corrosion coupon

Figure 2. Conceptual representation of using (RFID) corrosion coupon



Expected Results or Results To-Date

- **1.** Environmental chamber constructed under ASTM B-117 standard
 - Temperature, humidity, salinity control
 - System graphical user interface
- 2. Preliminary tests
 - **Evaluation of environmental chamber**
 - **RFID tag signal test**
- Validation of corrosion coupon (expected) **RFID coupon design**
- **Effectiveness of different RFID corrosion coupons**
- Further modification of RFID coupon (expected) 4.
 - Correlate the corrosion rate of the supporting material with that of pipeline material



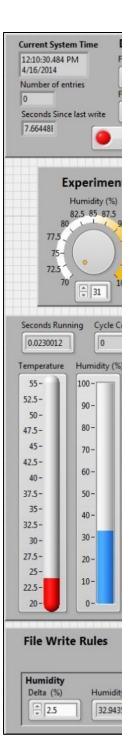


Figure 5. Corrosion testing chamber

Acknowledgments

This project is funded by DOT/PHMSA Competitive Academic Agreement Program.

References

- [1]. Fessler, R.R., Pipeline Corrosion, Final Report to U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety, Integrity Management Program, 2008.
- [2]. ASTM International, ASTM B 117 Salt Spray Testing Standard, 2011.
- [3]. Finkenzeller, K., RFID Handbook, Third Edition, 2010, John Wiley & Sons, Ltd. ISBN 978-0-470-69506-7.

Public Project Page

Please visit the below URL for more information: https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=505





REAL TEXAS A&M OIL & GAS CONSORTIUM

Datalogging File Path Control	System Limits &	Warnings	RFID Tag Information
C:\TestResults File Name [% C:\TestResults\4-16-2014 12%10%30 Start Start System Start Start Stop ent Parameter Control 90 34 35 36 91 32- -38 -39 97.5 31 -38 -39 100 30 25 -40	25 35 32 -28	Salinity (ppt) Lower Limit 2 Upper Limit 2 20 $\frac{30}{1}$ 40 20 $\frac{30}{1}$ 40 050 1050 0 60 0 60 PH Lower Limit Upper Limit 6 $\frac{8}{10}$ 10 4 -12 1 14 1 14	Tag 1 Tag 2 Tag 3 Tag 4 Tag 5 Tag 6 Selected Tag UID Number of Packets 30000013098A31C00000693 \bigcirc 500 Reader IP RSSI RSSIs to Average 192.168.1.10 \bigcirc 36.40 \bigcirc 5 RSSI \longrightarrow 34- \bigcirc 1 2 3 4 5 7 8 9 10 11 12 13 14 Time
34 33 32 31 32 31 30 90 29 14 28 27 26 25 24 23 3.000605 4 6 8	Experiment Chamber Temperature Humidity	0-	Solution pH Salinity 2- 2- 1- 0- 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 Time
dity Reading Humidity Triggered 43565	Temp Reading TempTriggered	PH Delta (PH) PH Reading	PH Triggered Delta (PPT) Salinity Reading Salinity Triggered

Figure 6. System graphical user interface