



Application of Amorphous Metals for Plastic Pipeline Detection



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Main Objective

This project was awarded to the University of North Dakota Energy & Environmental Research Center and Metglas, Inc., in order to evaluate the potential for using amorphous metal foil to enable the belowground detection of plastic pipelines.

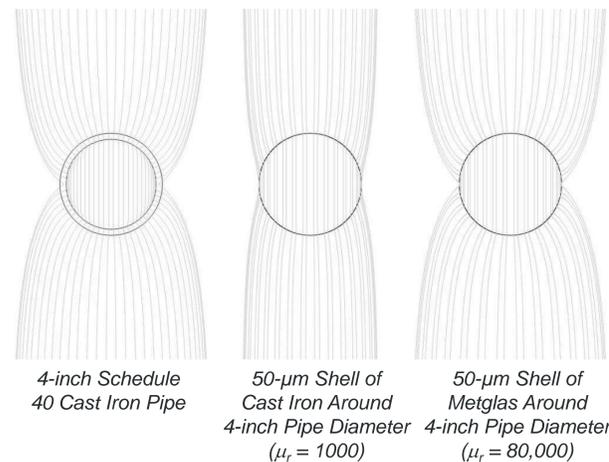


Figure 1. Comparison of the magnetic field distortion caused by conventional iron pipe and pipe wrap and an amorphous-based wrap.

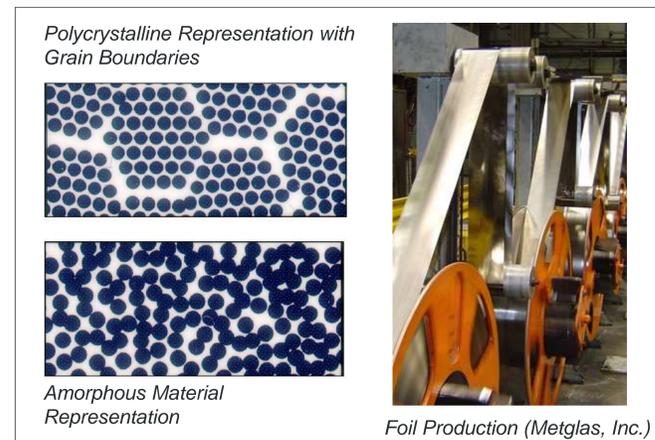


Figure 2. Left visualization comparing crystalline and amorphous atomic structure; right the production line for amorphous ribbon.

Project Approach/Scope

- Parametrically investigate the properties of amorphous metal with experimental measurements of Earth's magnetic field distortion.
- Validate a magnetostatic model for amorphous metals and use it to design a pipe detection prototype.
- Produce and evaluate the prototype design and explore industry interest.

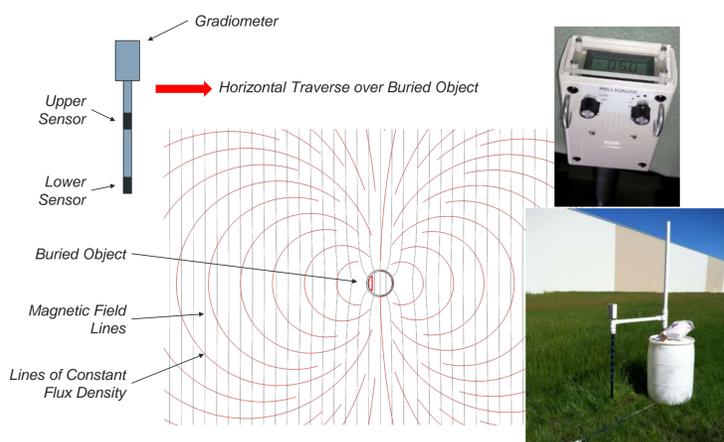


Figure 3. Left: schematic of differential gradiometer operation; right: the gradiometer and fixture used for data collection.

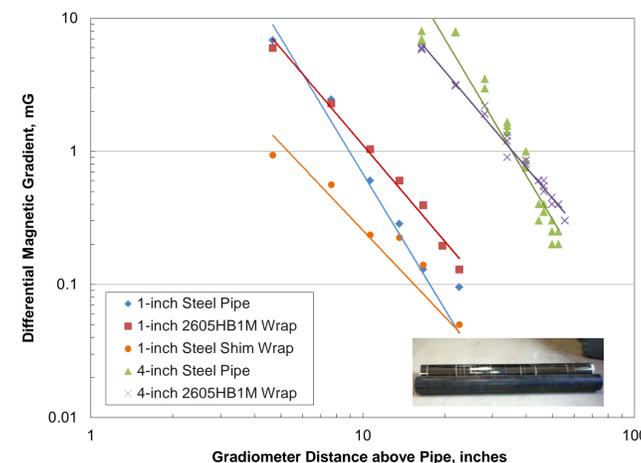


Figure 4. Gradiometer readings versus distance above pipe targets.

Expected Results or Results to Date

- Developed an understanding for the use of amorphous metal foils for pipe detection by exploring the parameters of:
 - Metal composition.
 - Foil pattern geometry.
 - Earth's magnetic field orientation.
- Determined that using the foil as a separate, detectable locating tape would result in a stronger and more consistent detection signal compared to direct pipe attachment.
- Identified that vertical tape orientation is preferred, which might be conducive for marking trenchless installations.

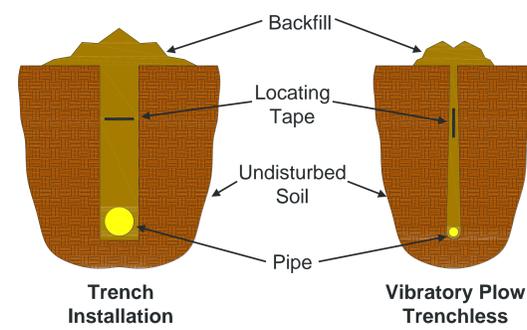


Figure 5. Trenchless installation details.

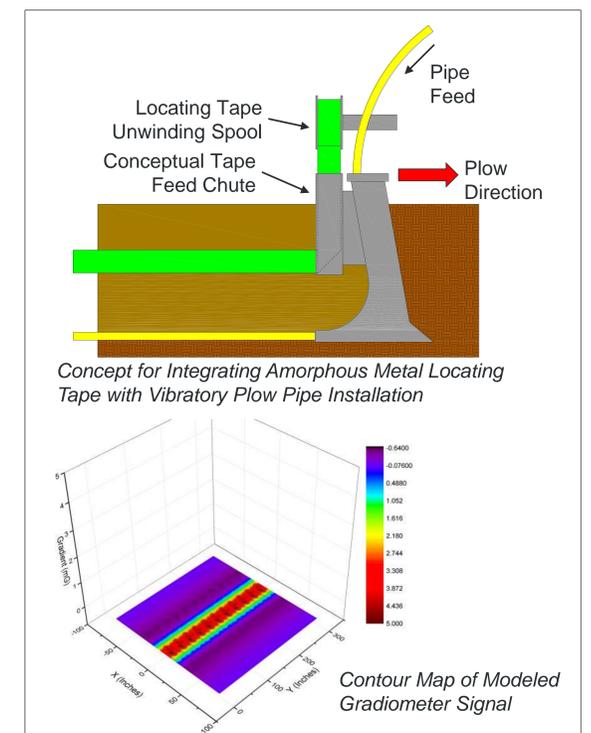


Figure 6. Conceptual installation method and modeled signal for an amorphous metal-based locating tape.

Acknowledgments

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Public Project Page

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<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=629>