Development and Field Testing of a Device for Measuring Cathodic Protection Potentials at Different Depths in Horizontal Directional Drilling Pipelines

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Abstract During the back-pulling process of horizontal directional drilling (HDD) pipelines, the coating inevitably experiences some degree of damage, compromising the pipeline's overall safety. To address this, cathodic protection is typically employed to provide additional protection to the damaged areas of the coating. However, assessing the effectiveness of cathodic protection in HDD pipelines presents significant technical challenges, particularly in accurately determining the polarization characteristics at varying burial depths. This study developed a deep-well polarization testing device and conducted field tests on a real-world oil pipeline. The results indicated that at a burial depth of 1 m, the pipeline showed an oxygen diffusion limitation zone. In contrast, at depths greater than 5 m, the soil’s oxygen content was extremely low, and no oxygen diffusion limitation zone appeared in the polarization curves. As the burial depth increased, the pipeline's polarization characteristics underwent substantial changes. This device offers a reliable method for measuring cathodic protection potentials at different depths in HDD pipelines, providing a scientific foundation for establishing cathodic protection evaluation standards and optimizing design parameters.

Keywords Cathodic protection, Horizontal directional drilling pipelines, polarization characteristics

Reference

[1] S. Shin, G. Lee, U. Ahmed, Y. Lee, J. Na, and C. Han, “Risk-Based Underground Pipeline Safety Management Considering Corrosion Effect,” Journal of Hazardous Materials 342 (2018): 279–289.