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Guided Microwave Detection of Corrosion Product in Insulated Pipelines

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Corrosion under insulation (CUI) is a common cause of pipeline failure in the oil and gas industry. Its detection with conventional inspection techniques is challenging due to the presence of the insulation layer and a protective metallic cladding that prevent direct access to the pipe surface. Guided microwave testing has been proposed as a cost-effective approach to screen an extended length of a pipeline for the presence of water, which is a necessary precursor for CUI. The pipe and metallic cladding naturally form a large coaxial transmission line in which the insulation acts as a dielectric and supports the propagation of microwave signals. The inspection is performed by launching the signal from an array of antennas permanently installed at one location along the pipeline. Wet insulation is then detected according to the radar principle since water results in the partial reflection of the incident microwave owing to the permittivity contrast between dry and wet insulation. This paper reviews the underpinning principles of long-range guided microwave testing and presents a new study aimed at enhancing the selectivity of the technique by detecting corrosion product inside the insulation which is more reliable indicator of CUI progression.