

2nd International Conference on

PETROLEUM ENGINEERING AND PETROCHEMICALS &

7th WORLD OIL AND GAS CONGRESS

May 22-23, 2019 | Dubai, UAE



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Electrochemical nanoparticle injection technique to repair wellbore leakages

Well cement has been commonly used in wellbore environment, such as wells for oil and gas extraction and CO₂ storage formation. For the safety of long-term operation of the wells, leakages in wellbore cement must be sealed. Nanoparticles in various slurries can be used to seal cracks in well cement. This study investigated the feasibility for developing an electrochemical method to inject nanoparticles into well cement not only to repair wellbore leakages and initial defects but also to extract the harmful ions (e.g. chlorides) simultaneously. Various experimental parameters

were studied including different surface charges, types and sizes of nanoparticles and the intensity of injecting power supply. The new technology was developed and tested under the lab condition as well as a simulated wellbore condition. Some details for the technology to be used underground from inside of steel casing are under development so that it can be used for repairing the leakage of well cement for the oil and gas industry as well as for CO₂ storage formations. Finite element models are being developed to simulate the nanoparticle injection and ionic transport processes of the technology.

Biography

Yunping Xi has completed his PhD in Structural Engineering from Northwestern University, Evanston, IL in 1991. He earned his MS in Structural Engineering from Central Research Institute of Building and Construction, Beijing in 1985 and BS in Civil Engineering from Beijing Institute of Civil Engineering and Architecture in 1982.

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