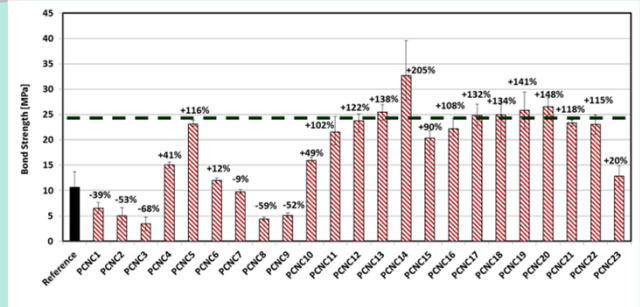


Wellbore Seal Repair Using Nanocomposite Materials

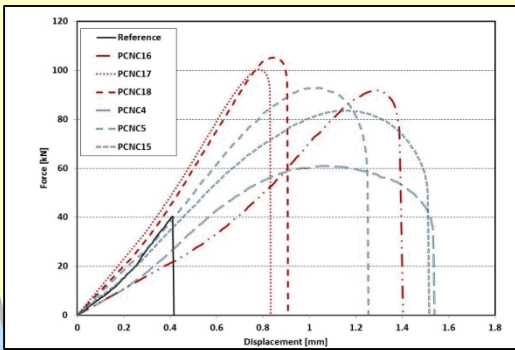
Project Number DE-FE0009562

Polymer nanocomposites (PNCs) have been developed as repair materials with superior properties suitable for expected wellbore environments.

PNCs have **bond strengths to steel, cement, and rock (shale)** that are more than 200% greater than microfine cement.



PCNs are much more **ductile** than cements, and absorb more energy before failure.



PNCs **penetrate and uniformly fill** gaps on the order of 10 microns



Wellbore Seal Repair Using Nanocomposite Materials

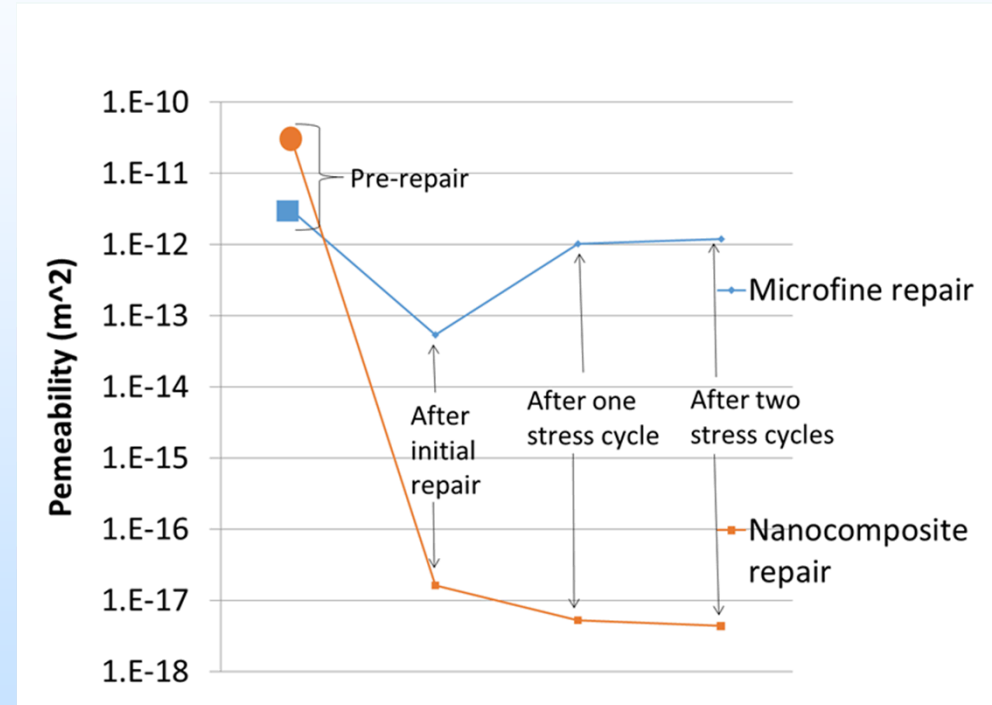
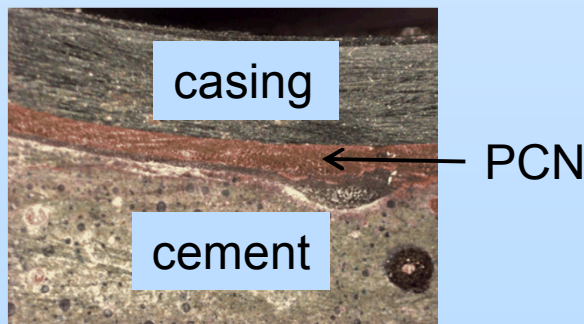
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PCN repair material restored damaged wellbore specimen to intact condition.

Wellbore specimens consisting of steel casing surrounded by cement sheath were prepared with various flaws such as microannuli.

Permeability of these specimens was measured under confining and casing pressures, and then **repaired and retested**.

Post-repair microphotograph shows complete filling of microannulus by PCN.



Repair with PCN did not degrade under cycles of confining and casing pressures.