HYDRIL®

Engineering Bulletin

Effect of Hydrogen Sulfide on Nitrile Elastomers

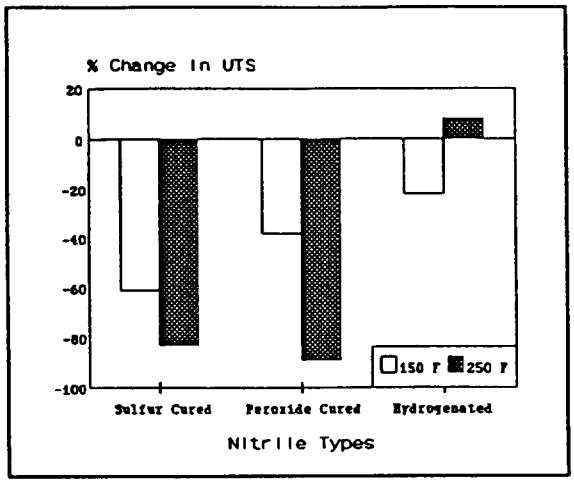

Figure 1: Change in Ultimate Tensile Strength

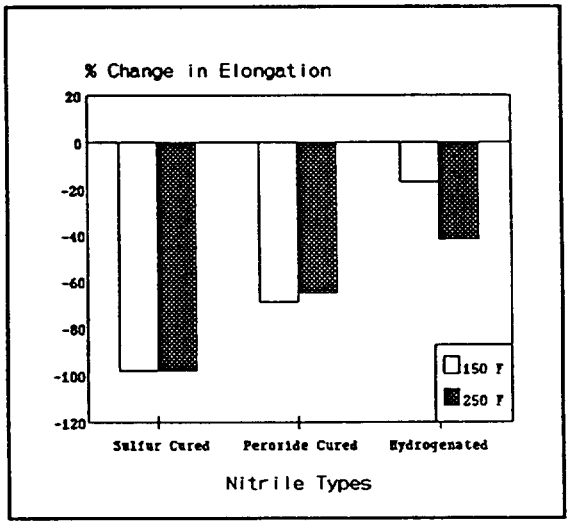

Figure 2: Change in Elongation

Though Hydril has not experienced problems with BOP elastomers in hydrogen sulfide (H_2S) containing environments, Hydril has been asked from time to time to comment on the effects of H_2S on elastomers.

Rubber materials in the oil field are attacked by a variety of agents, one agent that results in degradation of mechanical properties is H_2S H_2S alters the structure of the nitrile, causing hardening & decreasing elongation and tensile strength. These effects can decrease the life of seals and packing elements.

Figure 1 and 2 illustrate the amount of degradation as measured by elongation and tensile strength respectively after a 28 day exposure in the following environment: ***gas phase*** - 90% methane and 10% H_2S and ***liquid phase*** - 90% isooctane and 10% toluene

These Figures are representative of the relative resistance to H_2S. Sulfur cured nitrile was attacked the most while hydrogenated nitrile was attacked the least. High temperatures also degrade nitrile properties The effect of H_2S is compounded with the degradation due to temperature at higher temperatures

Nitrile elastomers are degraded by H_2S and temperature. The amount of degradation can be minimized by selection of nitrile rubber compound and processing. The result is that nitriles have utility in H_2S containing environments, but limits on H_2S concentration, temperature and length of exposure need to be imposed to ensure desired performance

Both manufacturers and users of nitrile elastomers have learned how to apply these products successfully in oilfield environments. Typical limits for long term exposure to H_2S are 1000 ppm concentrations at 180° - 200°F temperatures With proper selection of nitrile, the long term exposure limitations may be extended to 1500 ppm H_2S and about 225°F Short term exposures which are measured by hours or days can reach much higher H_2S concentrations without appreciable effect

Nitrile elastomers are usable in H_2S by limiting applications by temperature, concentration and/or length of time of exposure

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Most of the above data was taken from the Final Report of the API Elastomer Test Program, March 20, 1992, Dallas, Texas