

Engineering Bulletin

Zinc Bromide Brines Can Attack Nitrile Elastomers In BOP's

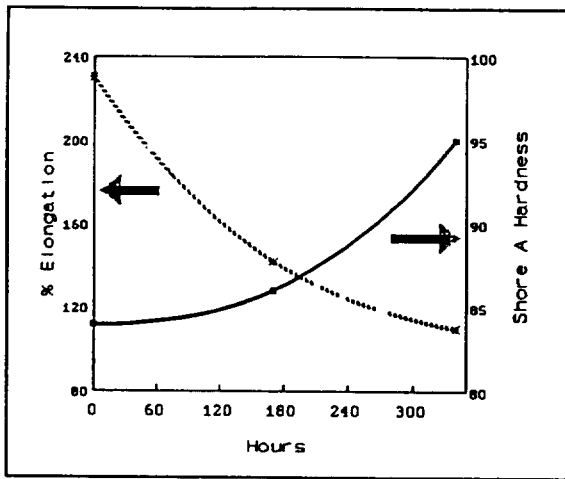


Figure 1: Nitrile Aging Effects

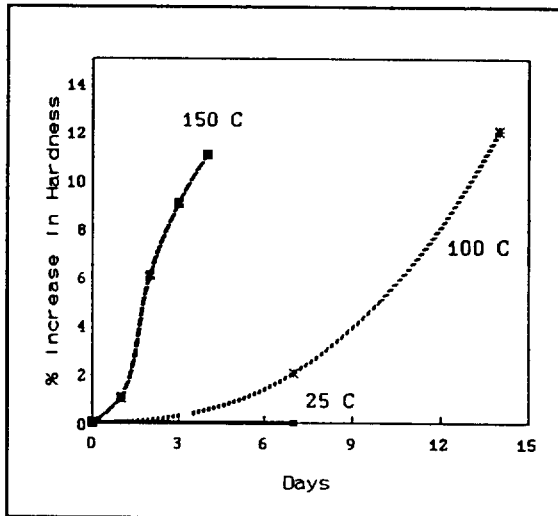


Figure 2: Temperature Effects on Nitrile

Drilling muds and completion solutions sometimes contain zinc bromide brines for increasing fluid densities. Zinc bromide fluids adversely affect blowout preventer elastomers, such as nitrile, used in BOP packing units and O-ring seals.

Many researchers, including those at Hydril, have demonstrated that zinc bromide degrades nitrile elastomers altering their mechanical properties.

Figure 1 shows effects of zinc bromide exposure time on nitrile elastomers. Hydrogenated nitrile at 84 Shore A hardness was immersed in 2.2 kg/L zinc bromide brine at 100°C. After only 7 days (168 hours), property changes were noticeable. After 10 days (240 hours), property changes were significant and in the undesirable direction.

Degradation of nitrile elastomers is strongly temperature dependent. At low temperatures, zinc bromide brines slowly alter material properties. At higher temperatures, changes in material properties occur rapidly and dramatically even with low concentrations of zinc bromide.

The properties of nitrile elastomers submerged in zinc bromide are strongly dependent upon temperature and this is presented in Figure 2. Though this Figure does not illustrate long term effects at low temperatures (such as less than 50°C), the degradation is still expected to occur but at a much slower rate.

Blowout preventer rubber goods must be inspected frequently because zinc bromide degrades nitrile elastomers. This frequency is dependent upon exposure time, temperature and concentration of the brine solutions. The inspection should look for increases in hardness of the elastomers and visual signs of deterioration.

Use these suggested blowout preventer inspection guidelines: (1) Inspect rubber goods every 90 days for low temperature conditions or weekly for temperatures above 50°C. (2) Hardness increases greater than 5% should be evaluated. (3) Hardness increases greater than 10% should result in replacement of the elastomers. (4) Inspect rubber goods before moving to a new well site. (5) If doubt exist about rubber conditions, replace the rubber goods.