

## 14.5 Common Refinery Corrosion Mechanism (continue)

### 14.5.4 Corrosion Under Insulation

- Corrosion under insulation (CUI) results from the collection of water in the vapour space between the insulation and the metal surface.
- CUI typically occurs if metal temperature  $\leq 120^{\circ}\text{C}$  ( $250^{\circ}\text{F}$ ).
- Typically piping is insulated above  $65\text{-}70^{\circ}\text{C}$  ( $150\text{-}160^{\circ}\text{F}$ ), but refineries with severe CUI target  $160\text{-}180^{\circ}\text{C}$  ( $320\text{-}350^{\circ}\text{F}$ ) instead.
- CUI is much worse if metal surface is not coated, insulation is in poor condition and/or is close to a source of moisture or  $\text{CO}_2/\text{SO}_2$  (cooling tower, condensate vent stack, flue gas stack, etc).

### 14.5.5 Brittle Fracture and Temper Embrittlement

- Brittle fracture is a catastrophic failure that occurs if steel is put under design stresses while it is below the brittle-to-ductile transition temperature (typically  $-100$  to  $200^{\circ}\text{F}$ ).
- Temperature embrittlement refers to an increase in the brittle-to-ductile transition temperature which occurs if the metal temperature remains above  $700^{\circ}\text{F}$  for extended periods (increase typically  $<200^{\circ}\text{F}$ ).
- 2.25Cr and 3Cr alloys suffer most from temper fracture and embrittlement.
- Equipment should not be pressurized to more than 25% of operating pressure until the metal temperature is well above the transition temperature (say  $300^{\circ}\text{F}$ ). Also applies to hydrotesting.

