



# n-TiO<sub>2</sub> Coatings for HPAL Application



George E. Kim



# *high pressure acid leach (HPAL)*



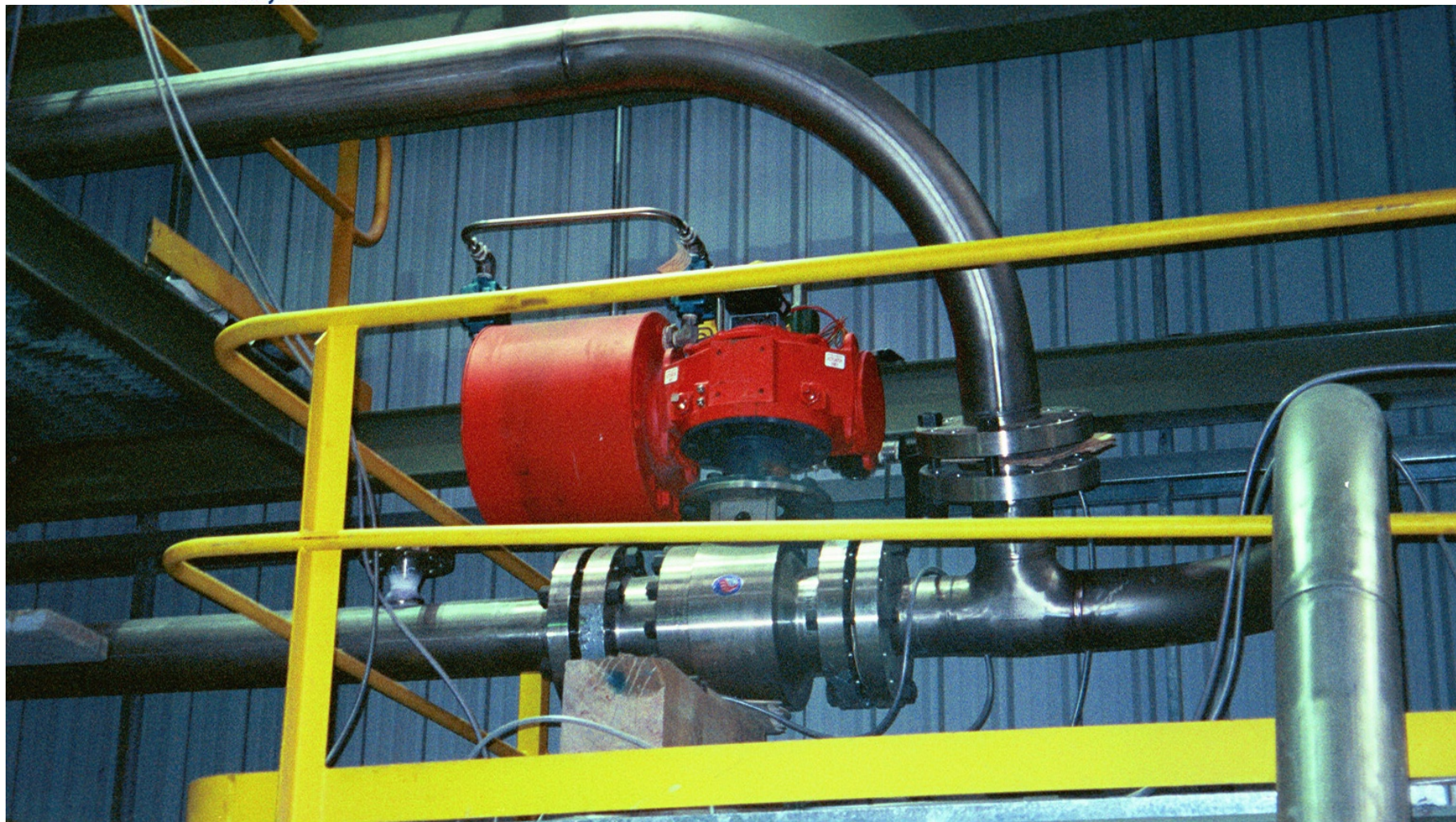
Cawse Nickel  
Autoclave

**Temperature:** 250 – 265 °C

**Pressure:** 4700 – 5500 kPa

**Concentration:** > 95 % H<sub>2</sub>SO<sub>4</sub>

**Solids:** > 20 wt %





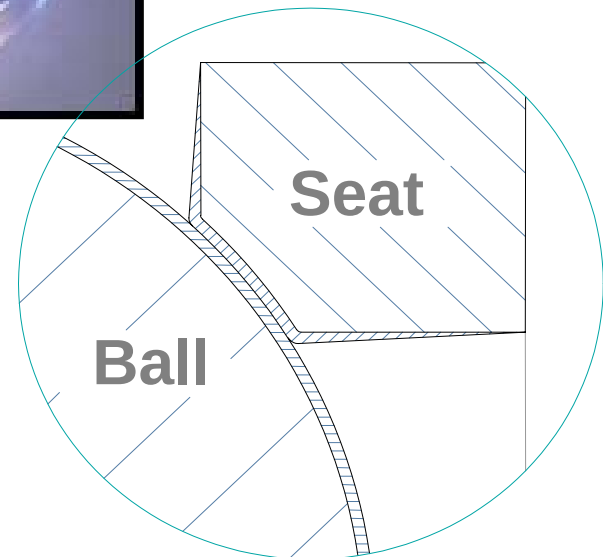
# *thermal sprayed ball valves*



Courtesy of Mogas Industries



Courtesy of FW GARTNER

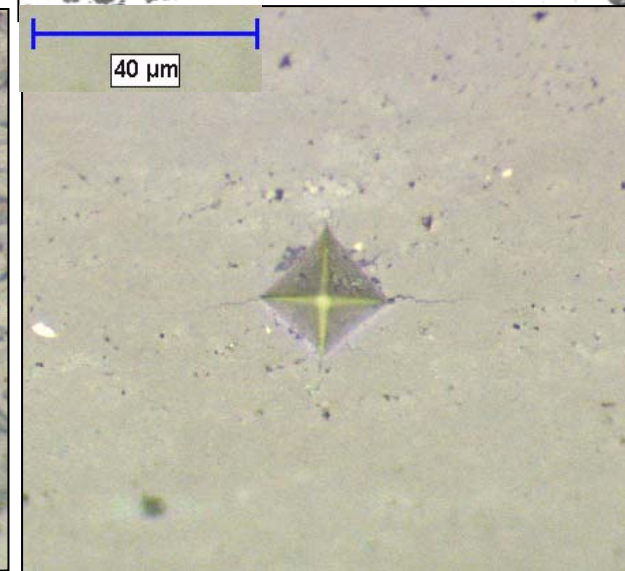
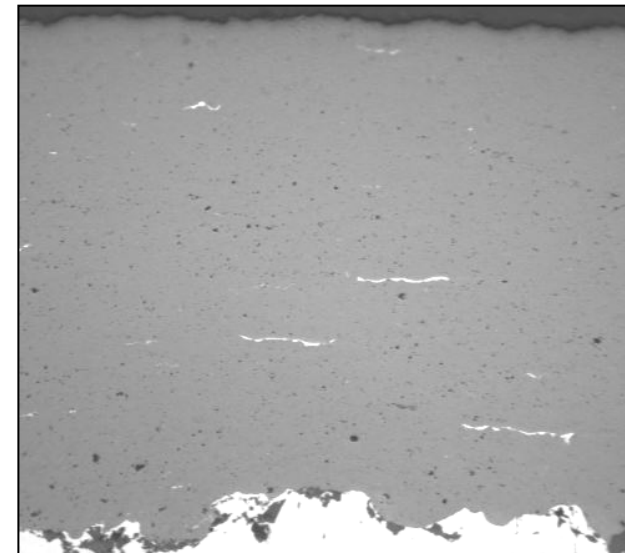
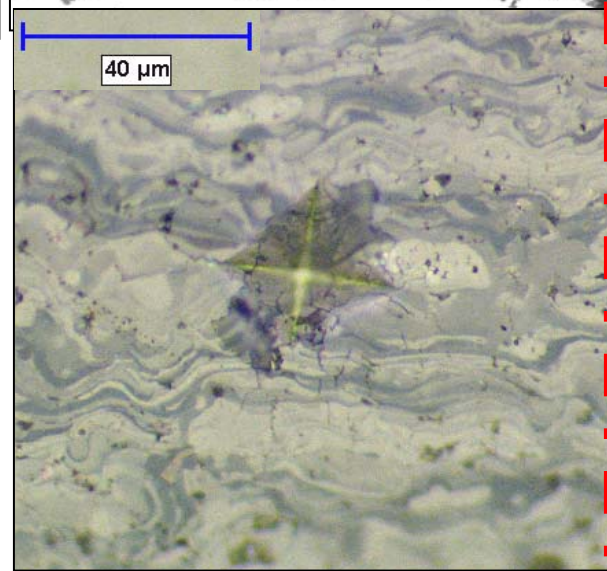
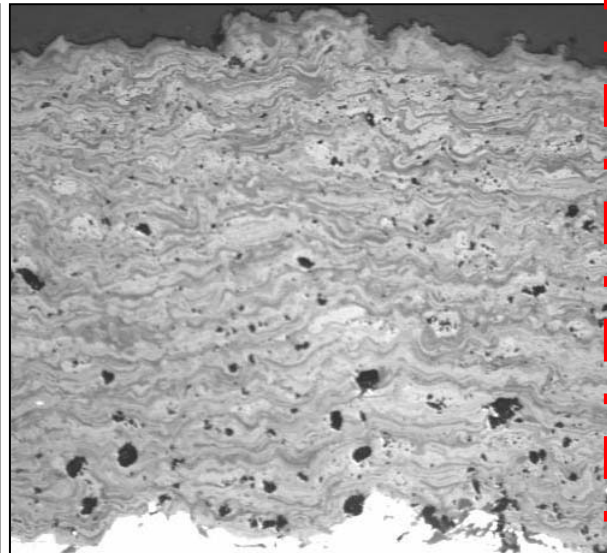
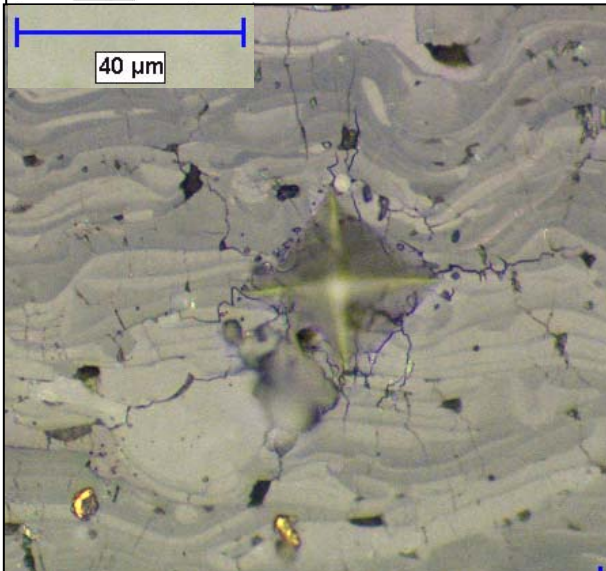
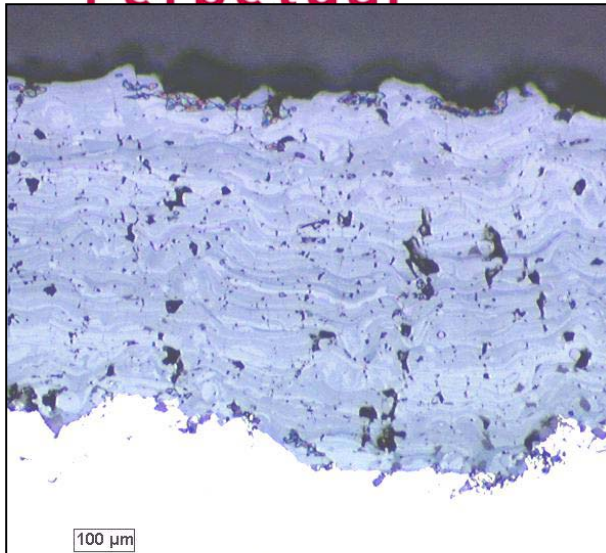


***“To develop a nanostructured coating customized for use on HPAL ball valves”***

## **Criteria:**

- 1. corrosion resistance**
- 2. wear resistance**
- 3. superior toughness**
- 4. good adherence**

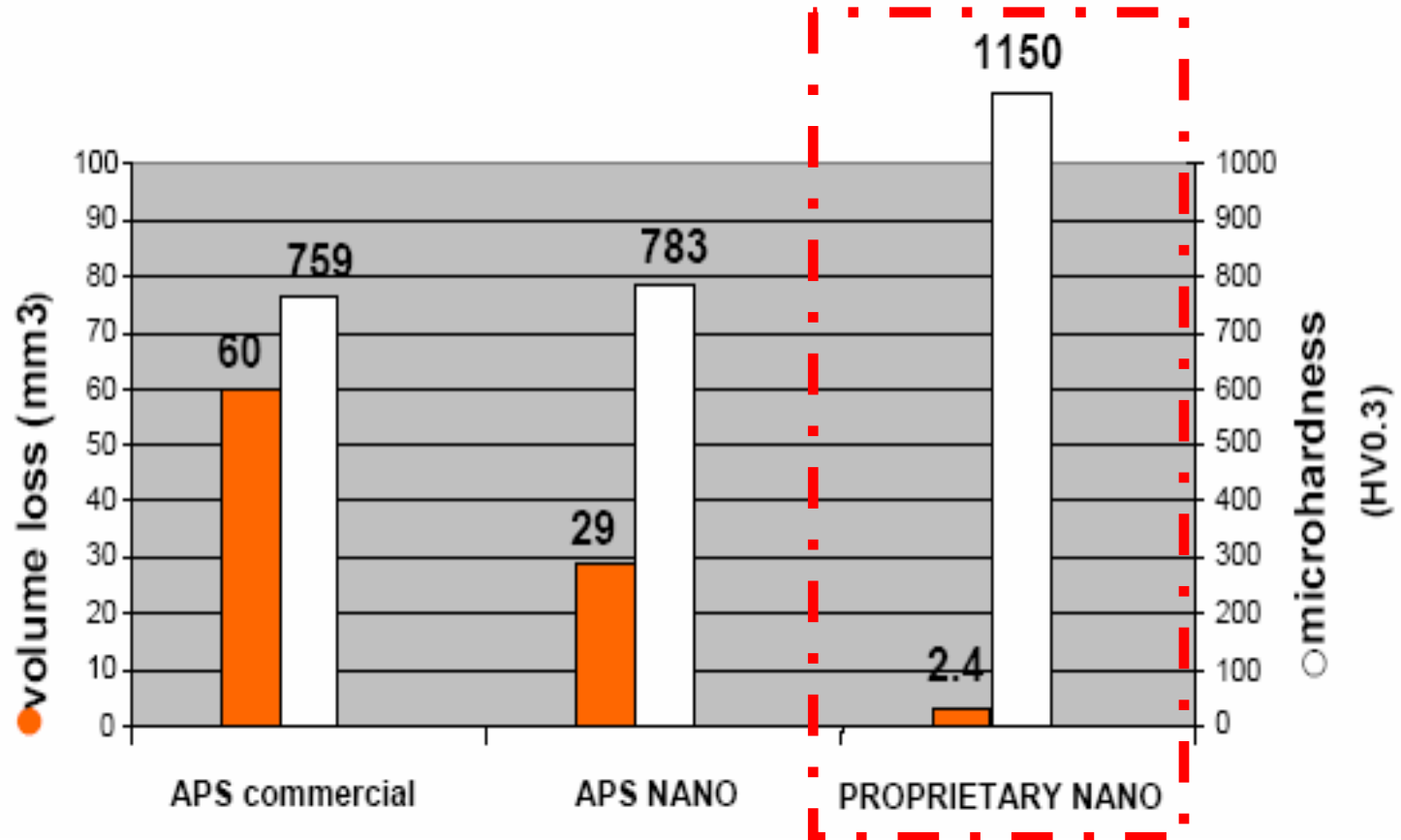
**Chose to proceed with a TiO<sub>2</sub>-base top coat with no bond coat**



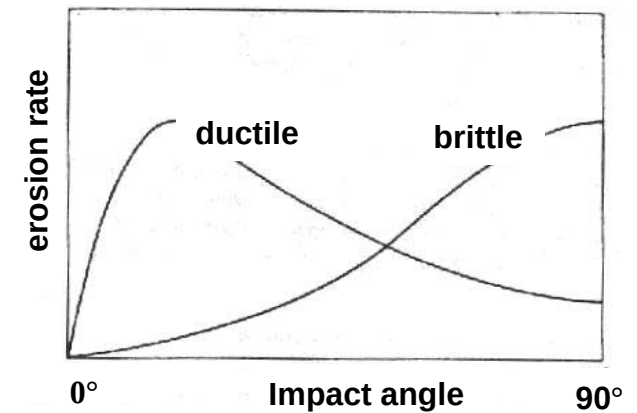
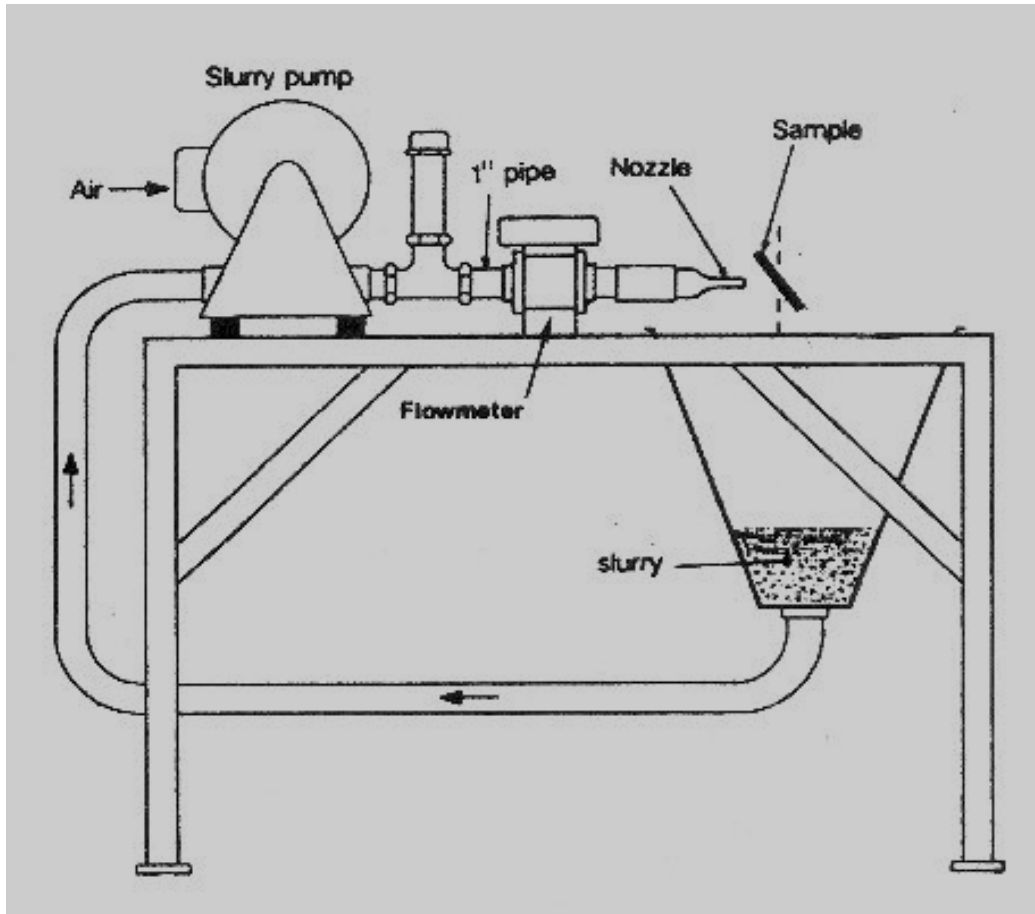
**APS commercial**

**APS nano**

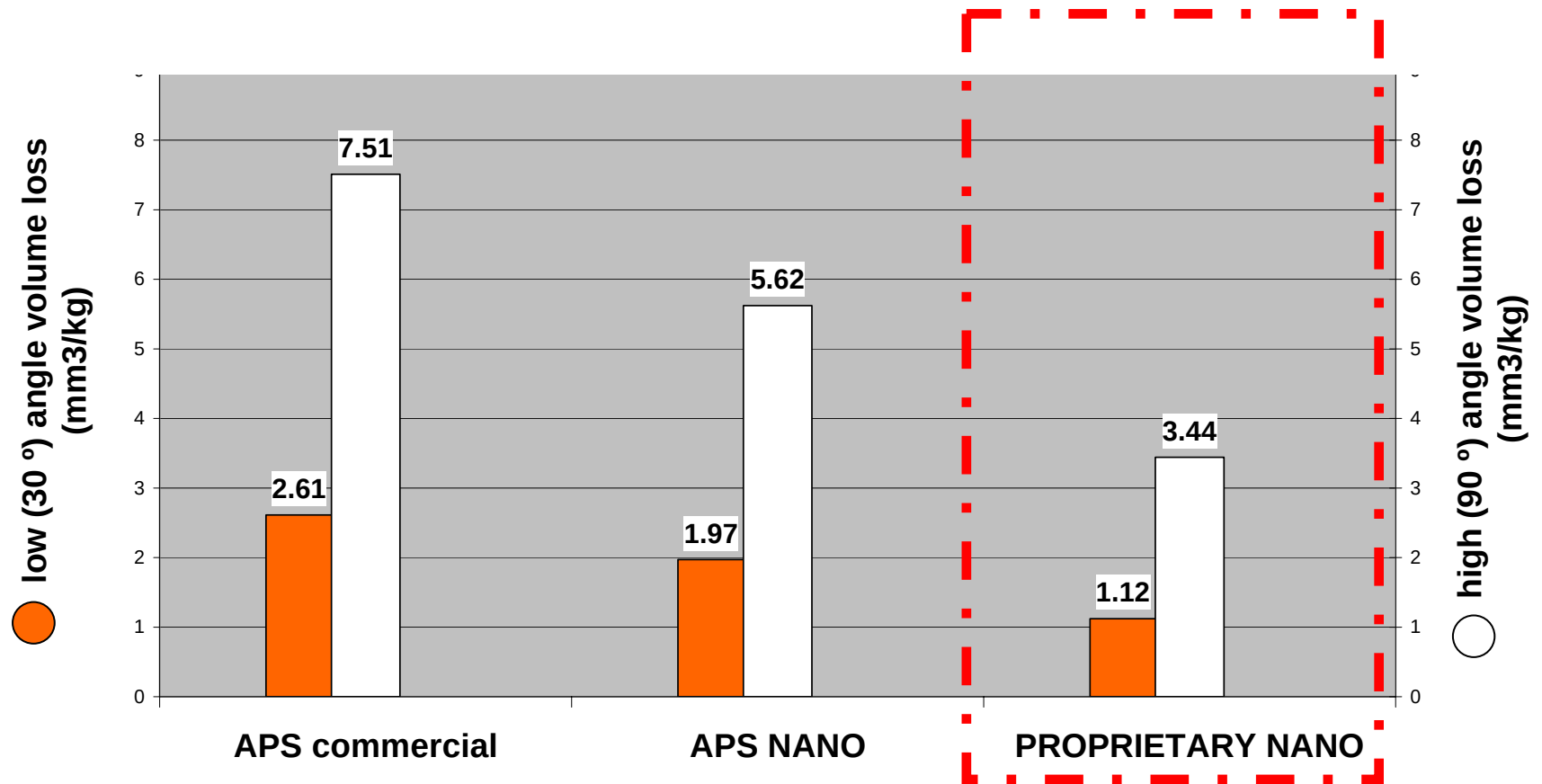
**Proprietary nano**



# *slurry erosion test*







**In 2003, LIHIR GOLD installed two 10" ID Ti Gr5 Mogas ball valves into the same service exposures and conditions for the same duration. Figure below provides photographs of the ball surface upon inspection after 10 months service.**



**Cr<sub>2</sub>O<sub>3</sub>-blend coating**



**n-TiO<sub>2</sub> coating**

# *locations with $n\text{-TiO}_2$ coated valves*



- patented nanostructured TiO<sub>2</sub>-base coating
- qualified by Mogas Industries and applied by FW Gartner onto production components
- positive field result
- will be incorporated to all ball valves for new mine, Ravensthorpe, in 2006
- Perpetual Technologies and FW Gartner are currently customizing the n-oxide coatings for a critical U.S. Navy application