

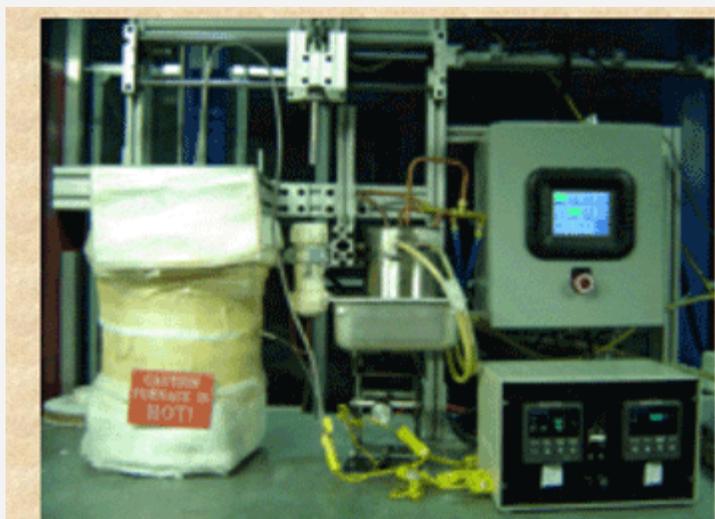
● Control of Soldering and Thermal Fatigue During Die Casting

Oak Ridge National Labs

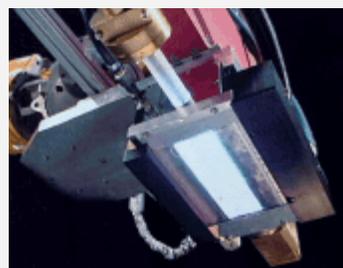
[G.Mackiewicz.Ludtka](#), [H. Xu](#), [Q. Han](#) and [C. Blue](#)

Goal:

To develop and demonstrate soldering-resistant coatings using high-density infrared (HDI)/plasma arc processing and to develop surface coating techniques and treatments to prevent heat checking using HDI surface hardening.

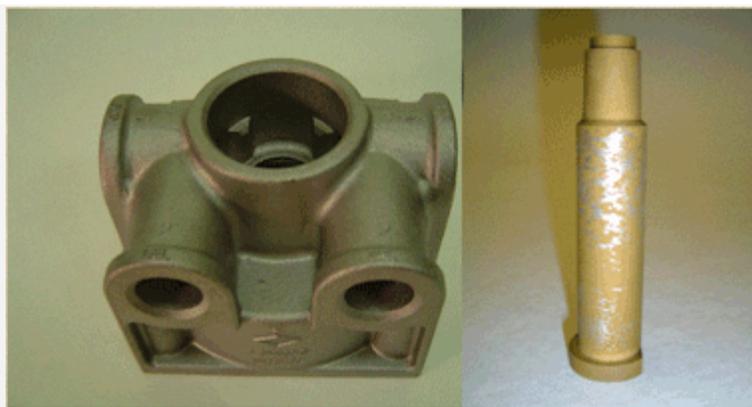


Automated Liquid Aluminum Dunk Test Apparatus

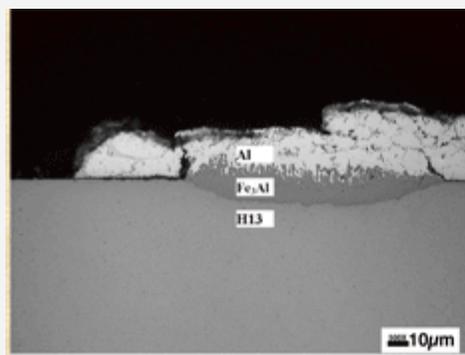


Accomplishments:

- Coating materials (WC, Cr₂C₃, TiN) were selected based on thermodynamic analyses and deposited on H-13 steel.
- Samples Coated with WC, Cr₂C₃ and TiN coatings performed more than 3 times better than the uncoated sample.
- A Boron coating deposited using a cathodic vacuum arc technique demonstrated no wetting during testing in molten aluminum, as predicted from thermodynamics analysis

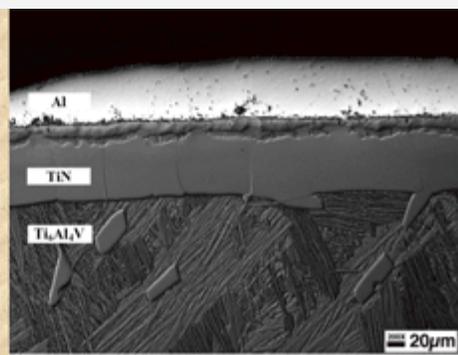


Automotive Die Casting Part and TiN Coated Pin



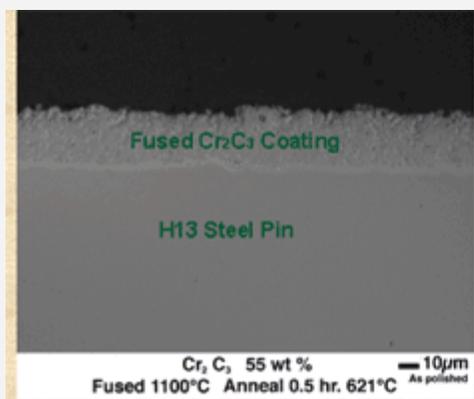
H13

Soldering occurs after only 16 cycles on uncoated H13

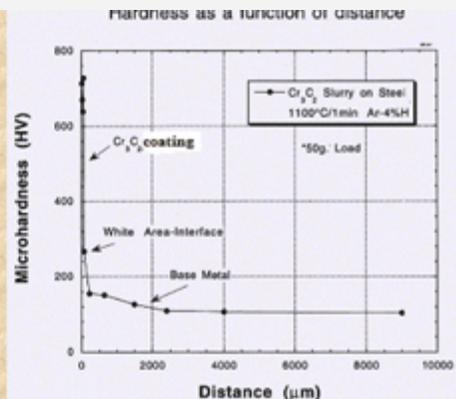


TiN Coating - Ti₆Al₄V

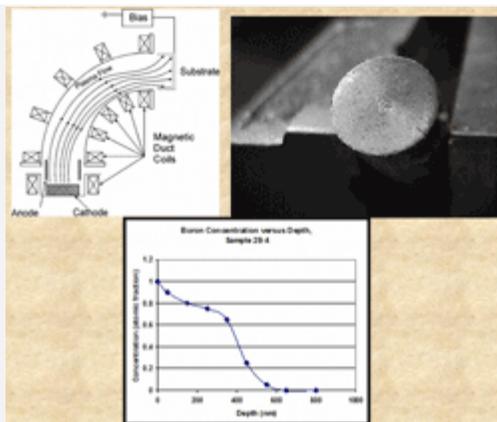
No Soldering occurs with TiN coating after 70 cycles



Cr₂C₃ 55 wt %
Fused 1100°C Anneal 0.5 hr. 621°C
As polished



Surface of a Coated Steel Pin and the Associated Hardness Profile



A thin Boron coating deposited using a cathodic vacuum arc process exhibited "no-wetting" during testing in molten aluminum.