



# Magnesium Elektron

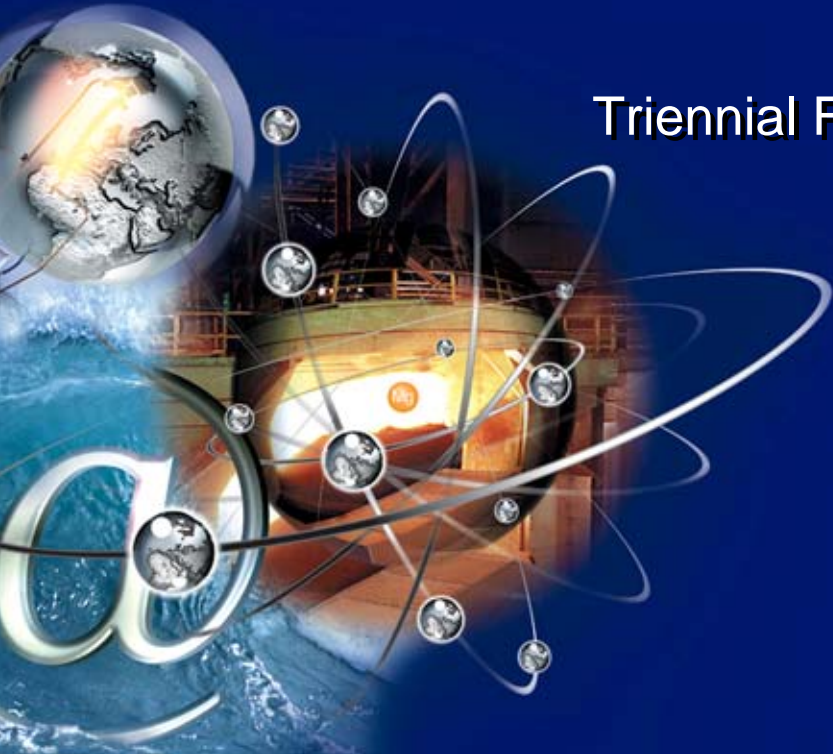
SERVICE & INNOVATION IN MAGNESIUM

## Flammability – Why do some Magnesium Alloys perform better than others ?

Triennial FAA meeting Atlantic City October 2010

27<sup>th</sup> October 2010

Paul Lyon



# Introduction

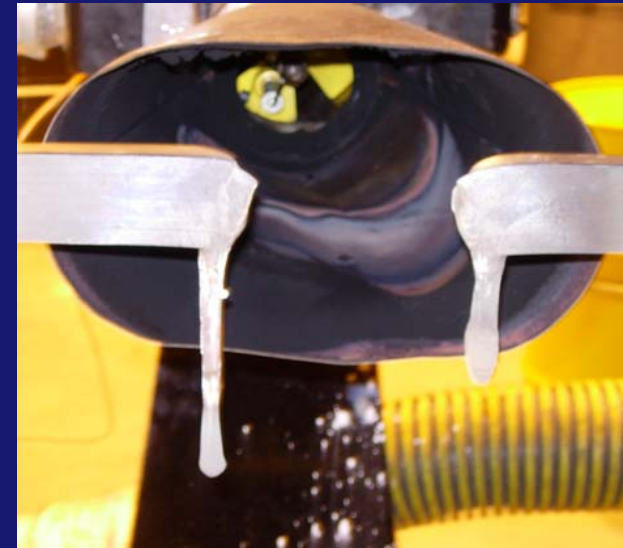
- Magnesium perceptions
- Feasibility check – FAA 2007



**Magnesium Elektron**

SERVICE & INNOVATION IN MAGNESIUM

WE43/Elektron 21

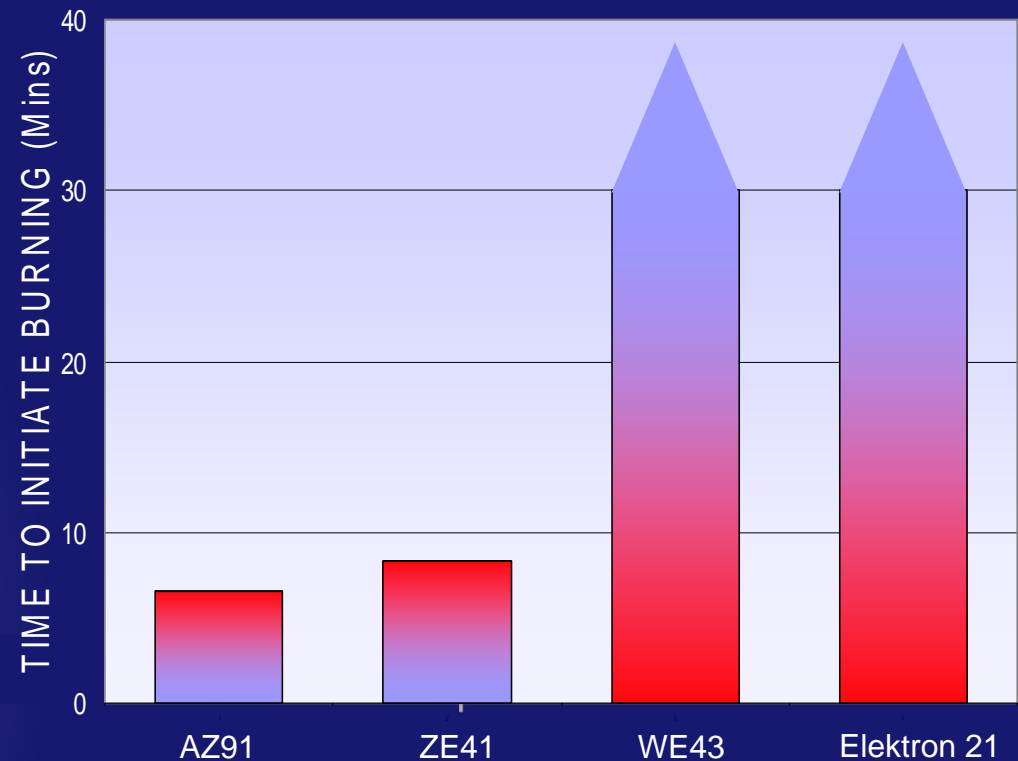


AZ31



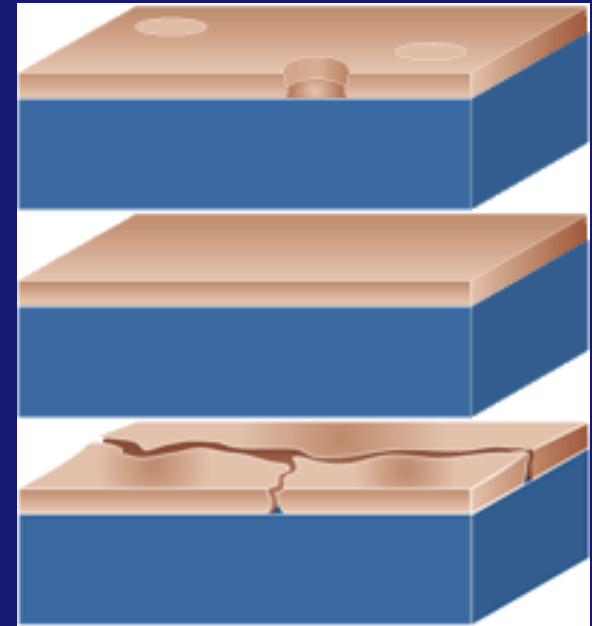
**Magnesium Elektron**  
SERVICE & INNOVATION IN MAGNESIUM

- Melting Point (Solidus)
- Alloy constituents
  - Mg-Al – Zn (AZ31, AZ91 alloys)
  - Mg – Y- Nd – HRE – Zr (WE43 alloy)



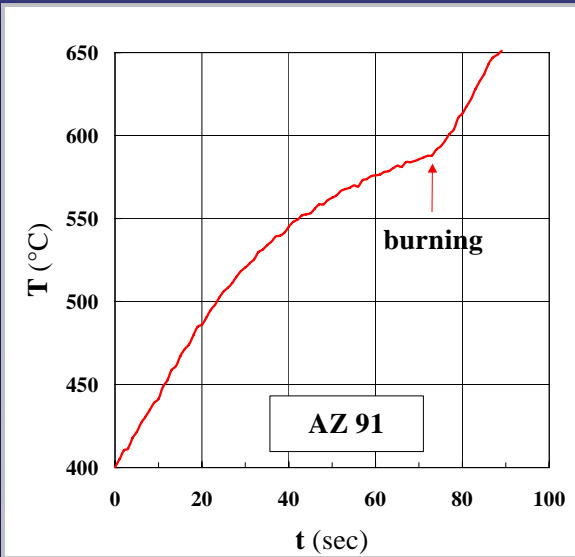
- Oxide formation
  - Energy of formation (Gibbs Free Energy)
  - Pilling Bedworth Ratio

	$\Delta G$ (KJ/Mole)
Yttrium Oxide	- 1112
Magnesium Oxide	- 1038



# Investigation \*

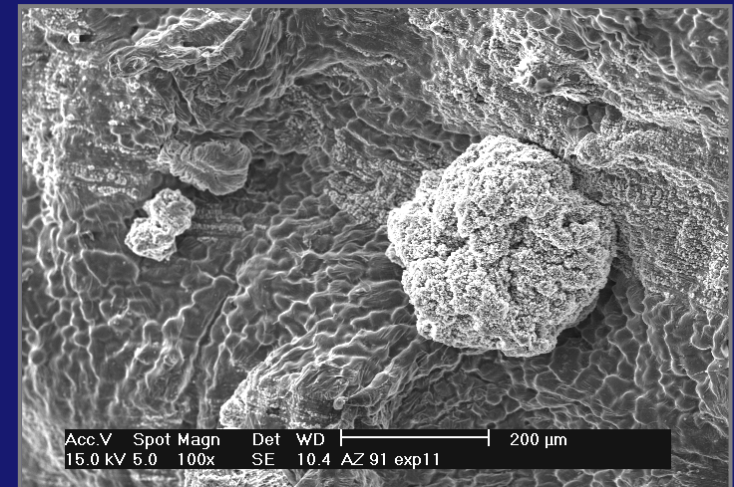
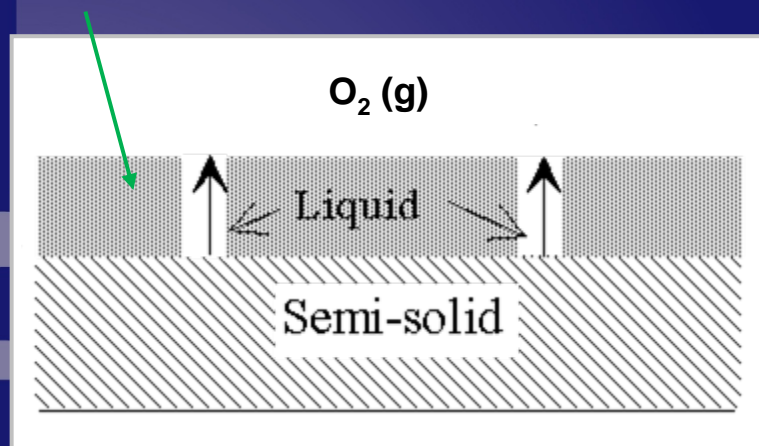
# AZ91 Alloy

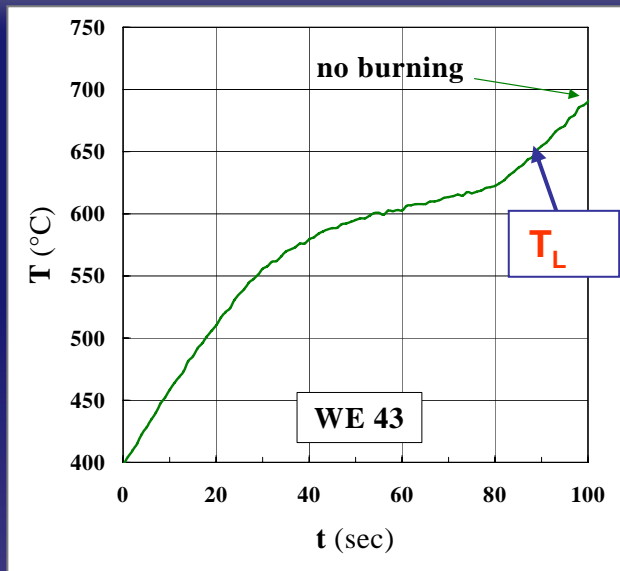


formation of "cauliflowers" on the surface of the sample, where the first flames appear

AZ91 :  $T_i = 580^{\circ}\text{C}$  (1076F)

dark MgO layer



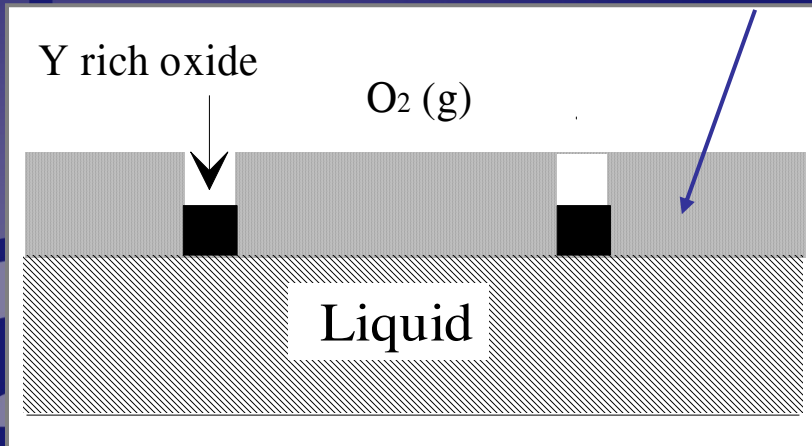


WE43 : no burning, even at  $T \gg T_L$

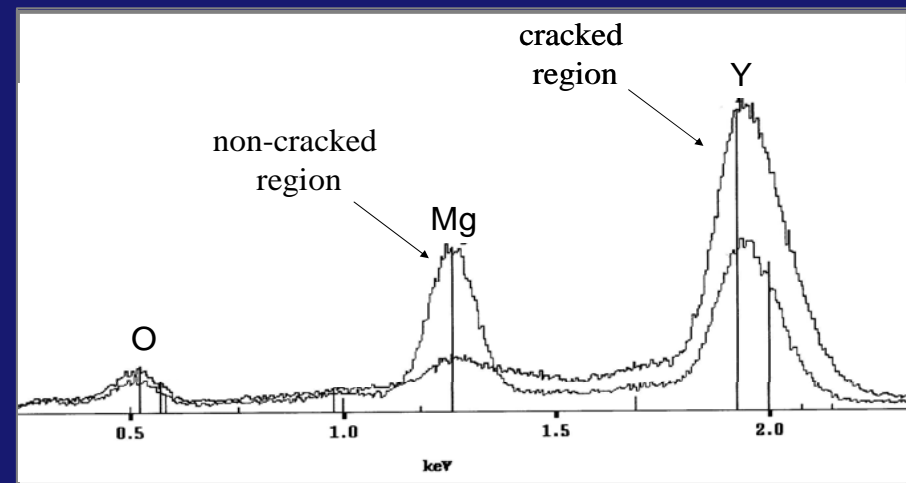
Regular surface with appearance of cracks with oxides present



Dark MgO layer



immediate formation of "protective"  $Y_2O_3$



EDX analysis of the 2 regions of the surface

- Production Capabilities
  - Surface Oxide
  - Casting large sections
- Elektron 43
  - Conforms to WE43 chemical specification
  - Wrought alloy

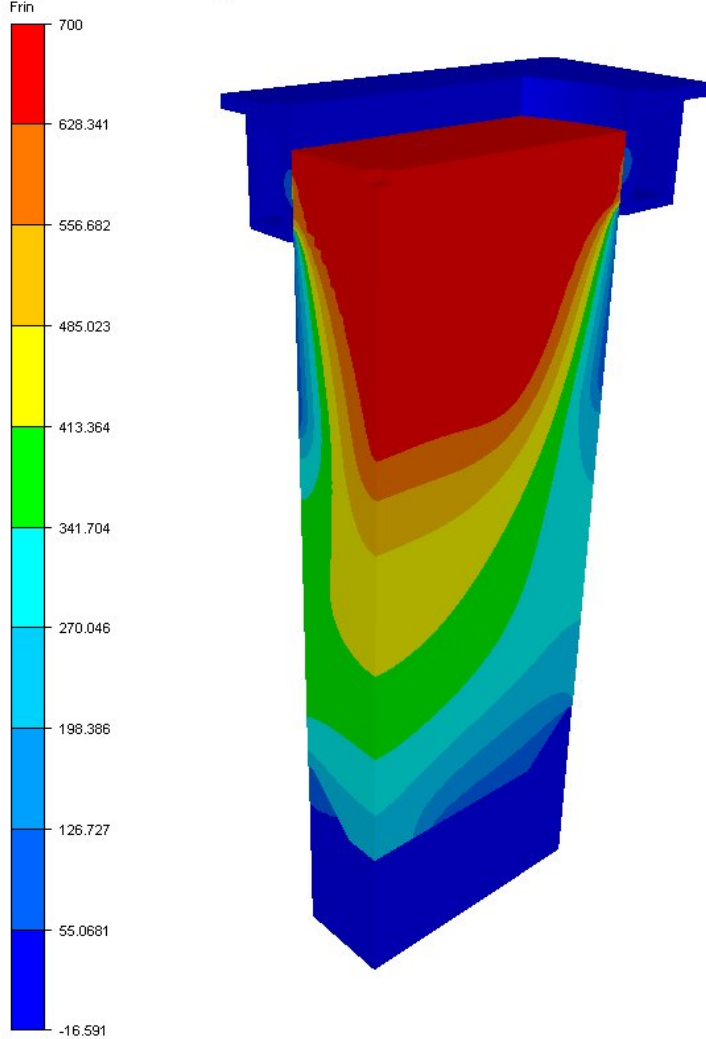




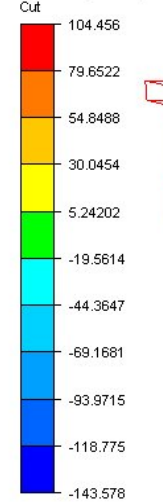
# Slab Casting Simulation

# FEM: Predicted Temperature Profile

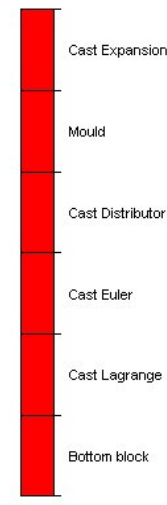
Temperature From case: v75-80\_w...



Stress \_ZZ-comp From case: ...



Parts



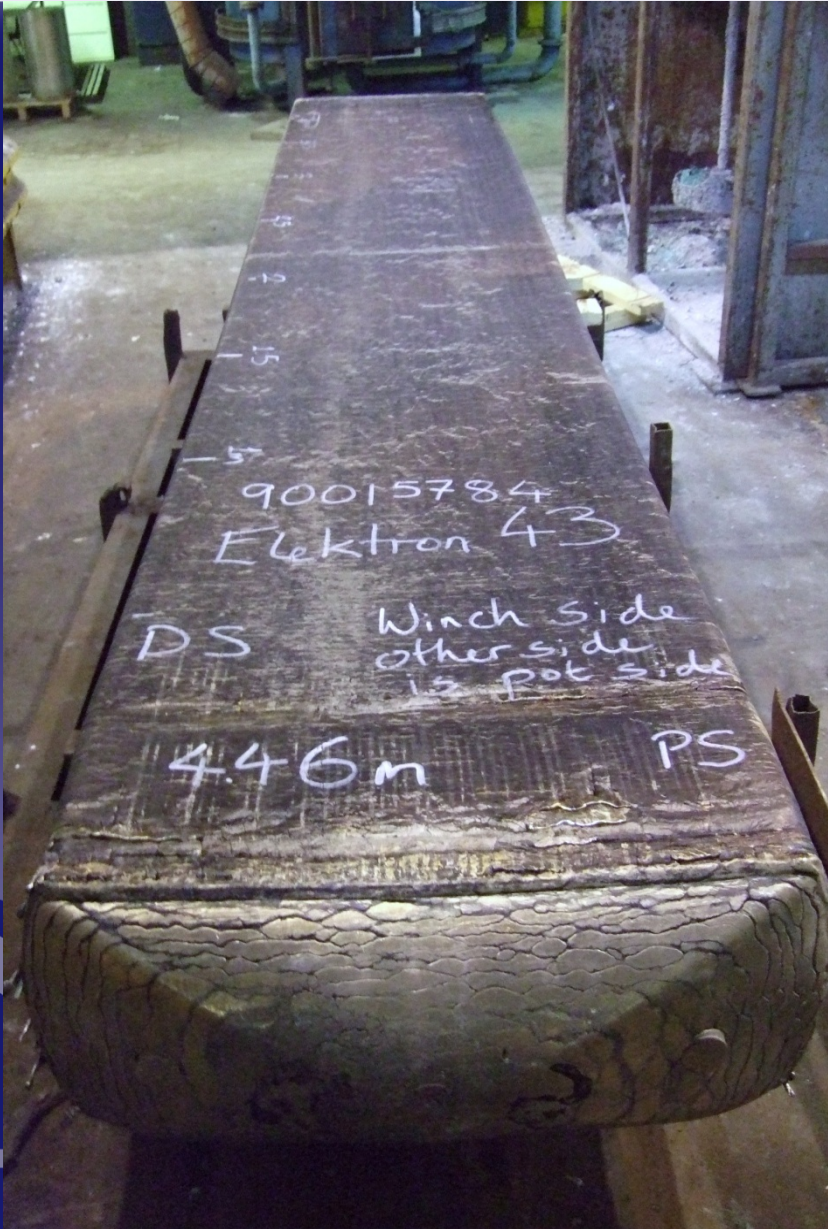
Temperature From case: v75-80\_w...



750.02s



750.02s



First Full length Elektron 43 slab  
4.46 M (176")



Capabilities

Extrusion





# Conclusions

- Flammability
  - Melting point (solidus)
  - Alloy constituents effect on surface film
- Production Capabilities (wrought)
  - Elektron 43
  - Extrusion
  - Rolling



Thank you for your kind attention

Questions ?



**Magnesium Elektron**  
SERVICE & INNOVATION IN MAGNESIUM