ENERGY EFFICIENCY AND ENVIRONMENTAL IMPACT OF MELTING SECONDARY ALUMINIUM IN TILTING ROTARY FURNACES

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What is a TRF?
Advantages

- Eliminates or considerably reduces use of salt flux
- Eliminates parasite air ingress
- Reduces metal pollution
- Facilities alloy change
- Lowest energy use
- High melt rates
Burner Control

- Enhance performance through monitoring charge conditions during cycle
- Minimize energy consumption
- Prevent metal loss
- Badly controlled burner =
  - Low yields
  - High energy consumption
Vari - Gas

• Automatically adjusts fuel flow
  – Type of charge
  – Phase of melt
• Flow of air or O² remains constant
• Flow of gas modulates automatically to optimise furnace atmosphere
• Initially burner set to neutral then adjusted to be
  – More or less gas lean
  – More or less gas rich
• Adjustment made either by
  – The operator from the control desk
  – Automatically via an oxygen sensor

• Optimises melting conditions for:
  – Clean scrap
  – Slightly contaminated scrap
  – Heavily contaminated scrap
Advantages

Remember! in a contaminated charge:

1kg of grease = ~1m3 of gas
• Exploits latent energy in charge
• Ensures flame adapted to melt phase:
  - Gas lean
  - Neutral
  - Gas rich
• Optimises yields
• Enables salt free melting for most scrap types
Air- Gas or Oxy-Gas?

- Oxy-gas systems:
  - Virtually nitrogen free (no Nox)
  - Use less gas
  - Hotter flame
  - Lower volumes of emissions

- However oxygen is not free!
- & can be very unforgiving if the burner is even slightly out of adjustment – leading to low yields
Air- Gas or Oxy-Gas?

- Vari-gas controls works with:
  - Air-gas burners
  - Oxy-gas burners
Gas consumption

- Theory (100% yield)
- Rotary (fixed axis)
- TRF air (clean charge)
- TRF O2 (clean charge)
- TRF O2 (dirty charge)
Contaminated Charges

- 1kg of grease = 1m³ of gas
- Vari-gas uses this latent energy
- Reduces pollution
- VOCs consumed in the furnace
- Fuel consumption as low as 12m³/tonne have been recorded with highly contaminated charges
Salt free melting myth or reality?

- Traditional furnaces use salt primarily to protect charge from rapid oxidation
- Salt only real benefit when used
  - in large quantities
  - in liquid state
- In a TRF, with a correctly regulated burner the dry salt technique has
  - NO real influence on yield
  - ONLY advantages
    - reduce dross sticking to walls
    - Limit exothermic reaction in poorly driven furnace
Vari-Gas Melting

- Salt free charge is heated whilst rotating the chamber slowly
- Once liquid
  - burner switched to low fire
  - Rotation increased to ‘concentrate’ metallic aluminium
- To facilitate separation of non-metallics small quantity of cryolite may be added
Advantages

- No salt
- Reduced energy consumption
- Residual ash is ‘non-toxic’
- Residual ash can be screened and used in the cement industry