Development of a cost-effective processing route for γ-TiAl

Motivation:

- Titanium aluminides show superior mechanical properties (high strength, low density) at high temperatures thus they impose major improvements of efficiency in aerospace and automotive energy conversion processes.
  BUT: Presently large-scale application of TiAl suffers from high material cost
- TiAl is currently produced by VAR of compound electrodes made from titanium sponge, aluminium and master-alloys (e.g. NbAl, CrAl, etc.)
- Challenges in today´s production include homogeneous alloying of solid components and the high price of titanium sponge, as an energy intensive, strategic raw material.

➡ An alternative processing route was designed and has reached pilot scale, starting from readily available, cheap raw-materials.

Process idea:

Raw materials:
TiO2 pigment
alloying oxides
aluminium granules
booster

Aluminothermic reduction

Liquid, homogeneous metal-melt

In-line-casting

Raw γ-TiAl electrode

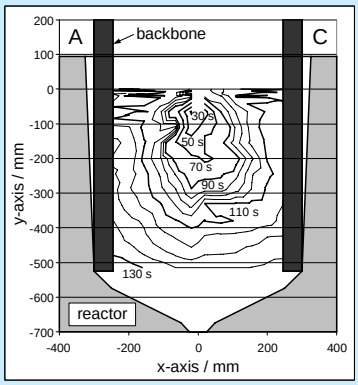
Deoxidizing agent

Deoxidation by PESR

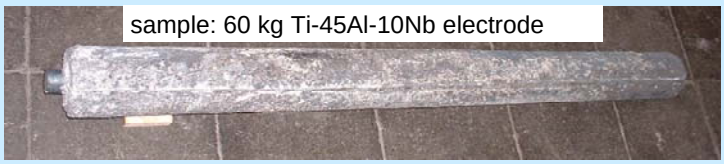
Primary γ-TiAl electrode

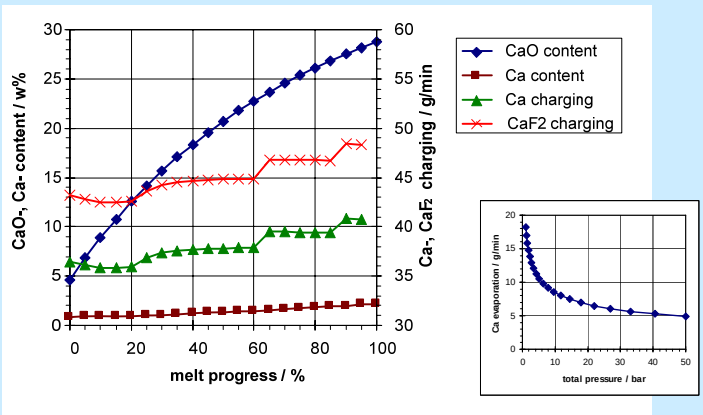
Refining by VAR

Final γ-TiAl ingot



Tracking of the progressing reaction front





Evolution of slag chemistry and control for homogeneous deoxidation

Contact: Prof. Dr.-Ing. B. Friedrich
IME Process Metallurgy and Metal Recycling
RWTH Aachen University
Intzestr. 3, 52056 Aachen, Germany
Phone: +49 (0)241 80 95850
e-mail: BFriedrich@ime-aachen.de