Titanium is produced by the Kroll process since 1946 with:
- low efficiency (batch wise operation)
- high cost
- complicated equipment
- low productivity (process takes up to six days)
- high energy consumption
- limited capacities for the increasing demand for titanium

→ need for a faster and cheaper production process

Composite anode:
- Anode composition (C, TiO₂) calculated according to the chlorination of pellets via packed bed process
- Reaction proceeds via the shrinking particle model → optimal composition matches the stoichiometric one
- Calculation via the „extend of reaction“-mechanism

Result:
It is possible to form titanium by in-situ chlorination of a TiO₂ composite anode and electrolytic reduction of TiClₓ at the cathode.

Work packages of the process development:
- Buildup of an electrolysis cell
- Electrolyte development
- Development of a TiO₂-C-composite anode
- Testing the feasibility of the proposed process

Invention of the new IME-process:
Forming titanium by in-situ chlorination of a TiO₂ composite anode and electrolytic reduction of TiClₓ at the cathode.

Experimental proof that TiCl₂ forms with priority

Current density vs. potential – anodic reactions

Experimental proof that TiCl₂ is electrochemically reduced before other electrolyte components

Current density vs. potential – cathodic reactions

Thanks for Funding:
5a Helmholtz Young Investigators Group together with the DLR in Cologne:
„Electrolytic Production Routes for Titanium Matrix Composites“