

# **ELECTROCHEMICAL REDUCTION OF TITANIUM DIOXIDE IN MOLTEN OXIDE ELECTROLYTES**

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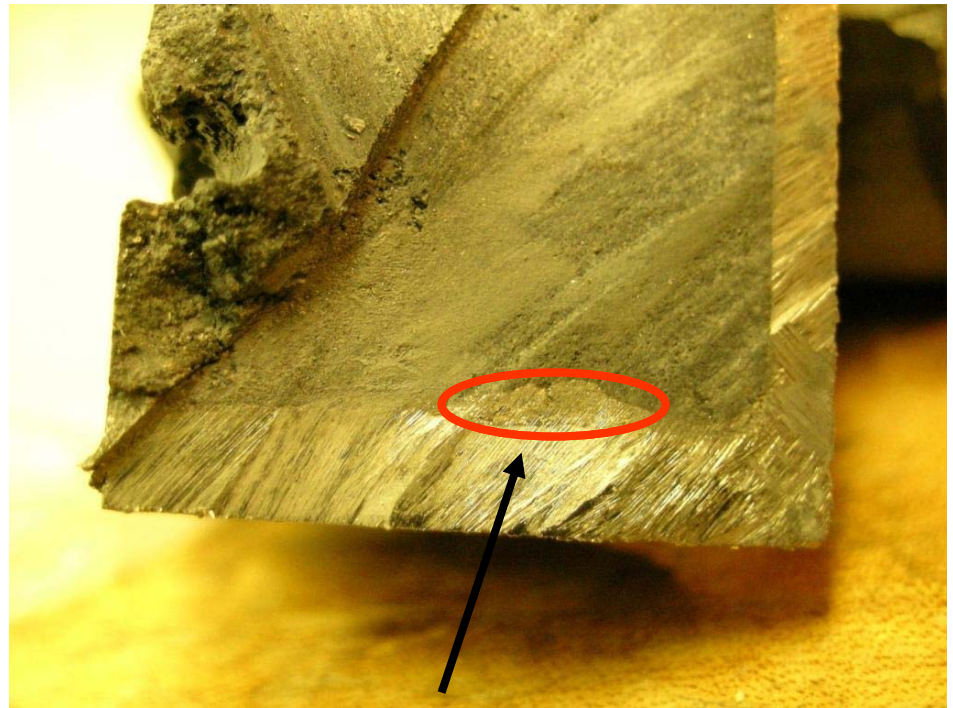
# Ti PRODUCTION BY MOLTEN OXIDE ELECTROLYSIS

1550 °C



Solid Ti

1700 °C



Liquid Ti

# CHOICE OF ELECTRODE MATERIAL

## **special conditions:**

- high melting point of titanium (1675°C)
- aggressive solubilizing power of oxide melts

## **special needs:**

- chemical and electrochemical stability
- electronic conductivity

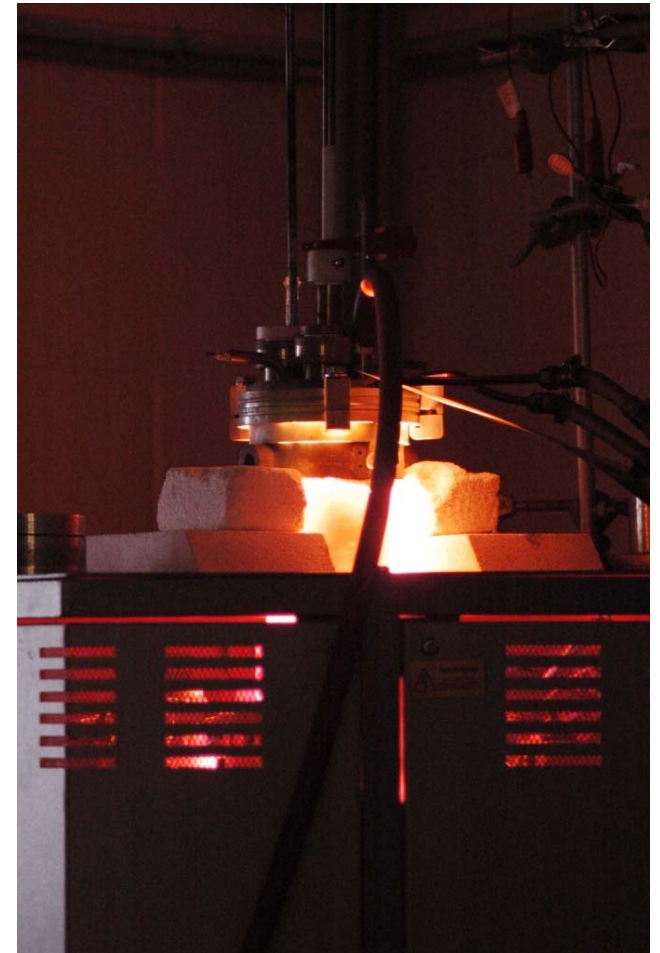
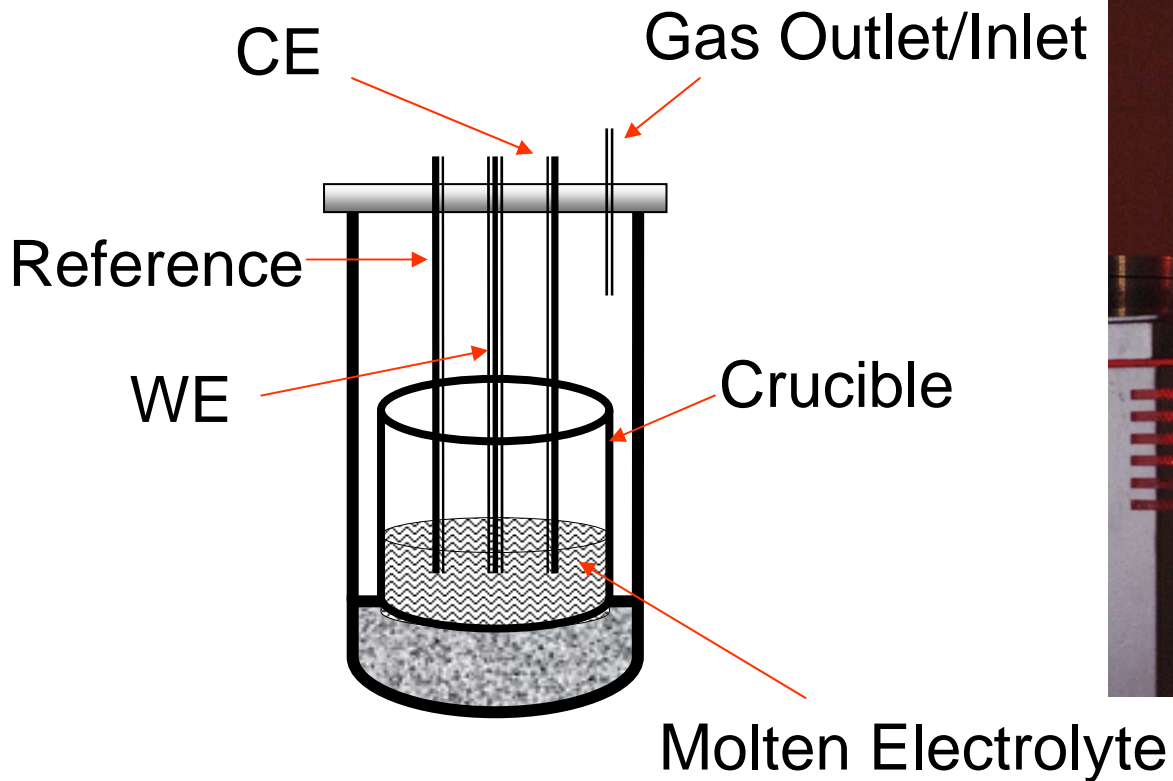
# CHOICE OF ELECTROLYTE

- Low melting temperature
- Wide potential window
- Good ionic conductivity
- Electronically insulating
- Capable of dissolving  $\text{TiO}_2$

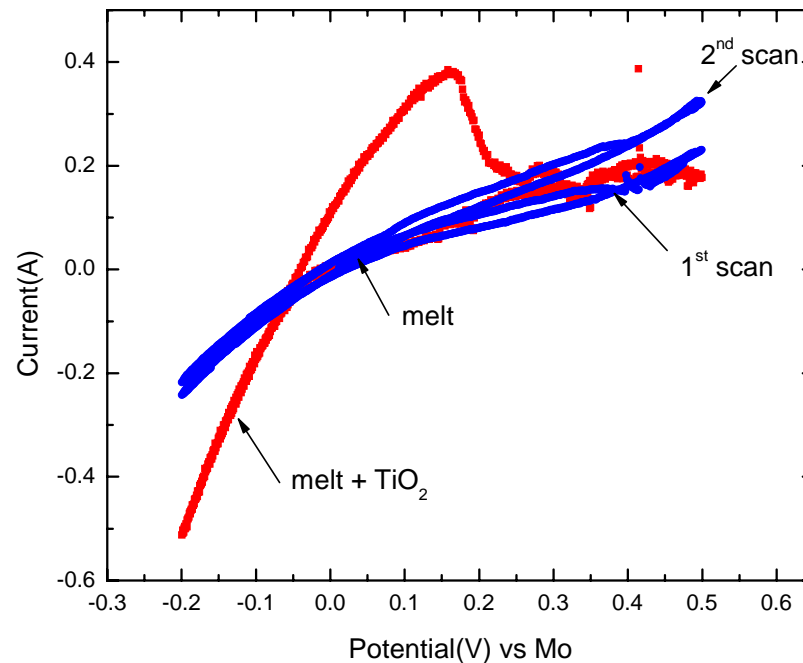
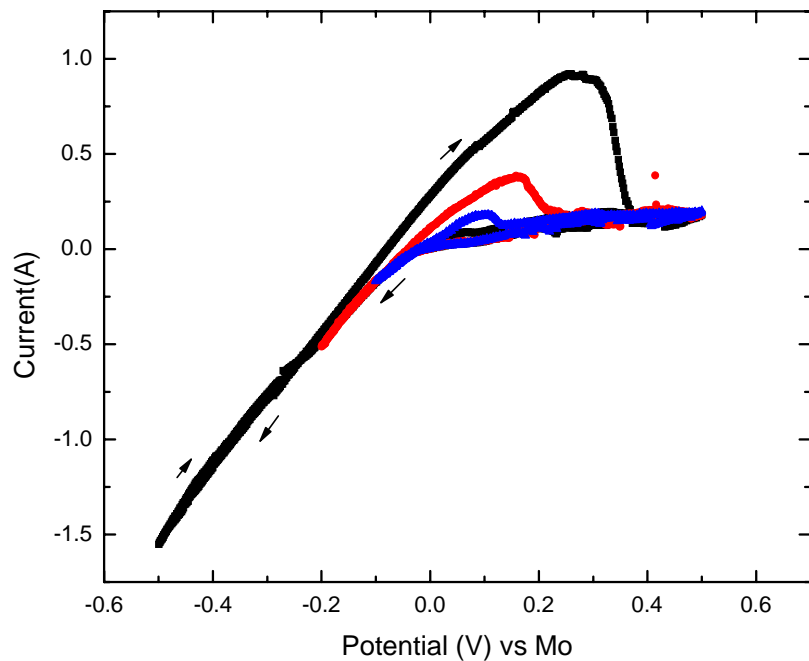
# EMF SERIES AT 1700 °C

TiO <sub>2</sub>	1.53
TiO	1.66
MgO	1.69
Al <sub>2</sub> O <sub>3</sub>	1.80
SrO	1.89
BeO	2.06
CaO	2.10
Y <sub>2</sub> O <sub>3</sub>	2.31

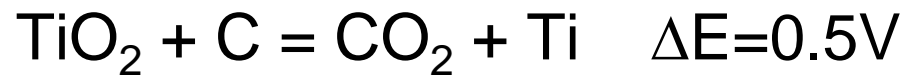
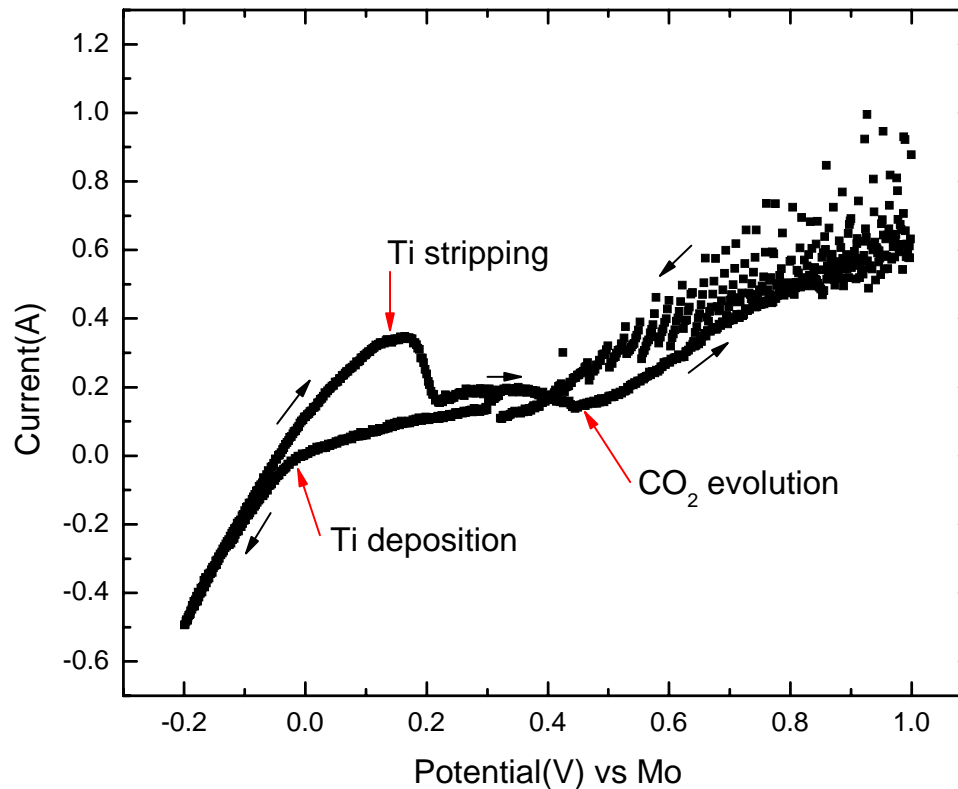
# EXPERIMENTAL SETUP



# CYCLIC VOLTAMMETRY AT CARBON ELECTRODES -1550 °C



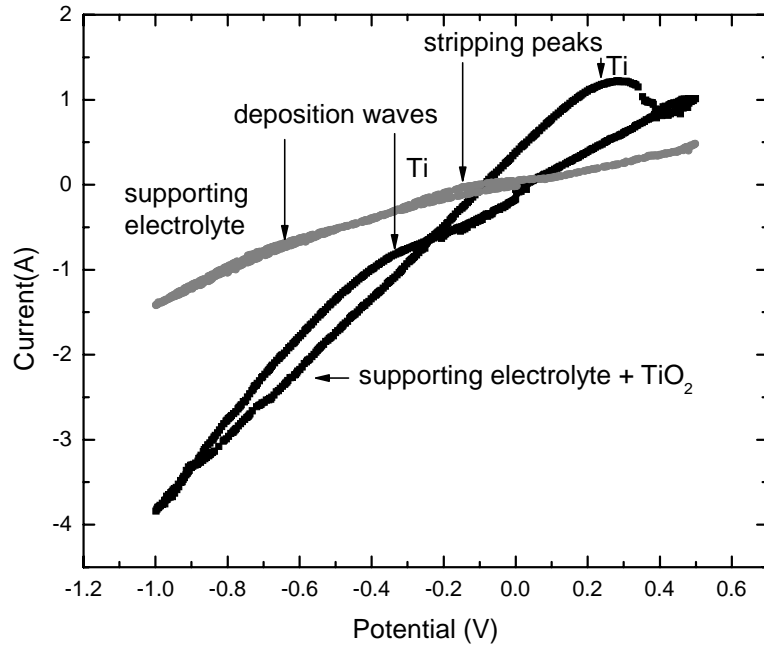
# CYCLIC VOLTAMMETRY AT CARBON ELECTRODES – 1550 °C



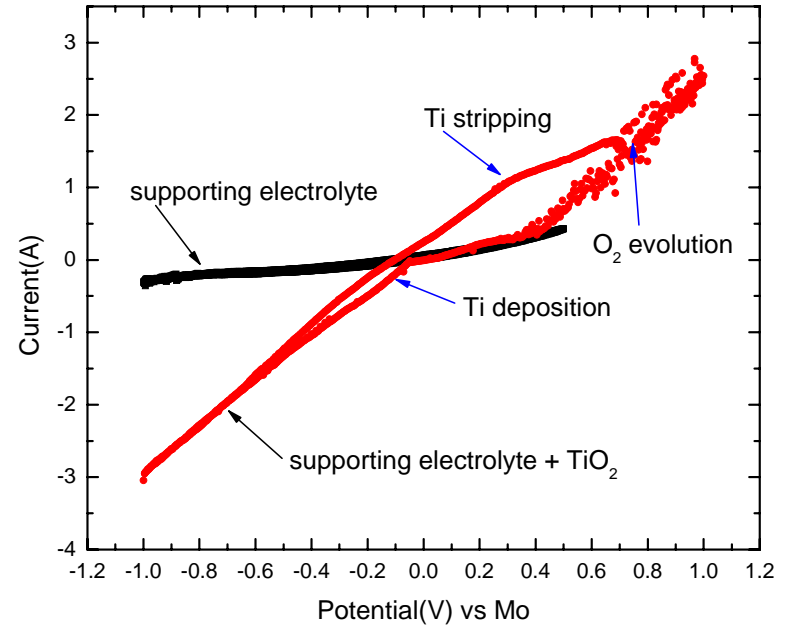


# CYCLIC VOLTAMMETRY AT VARIOUS ELECTRODES

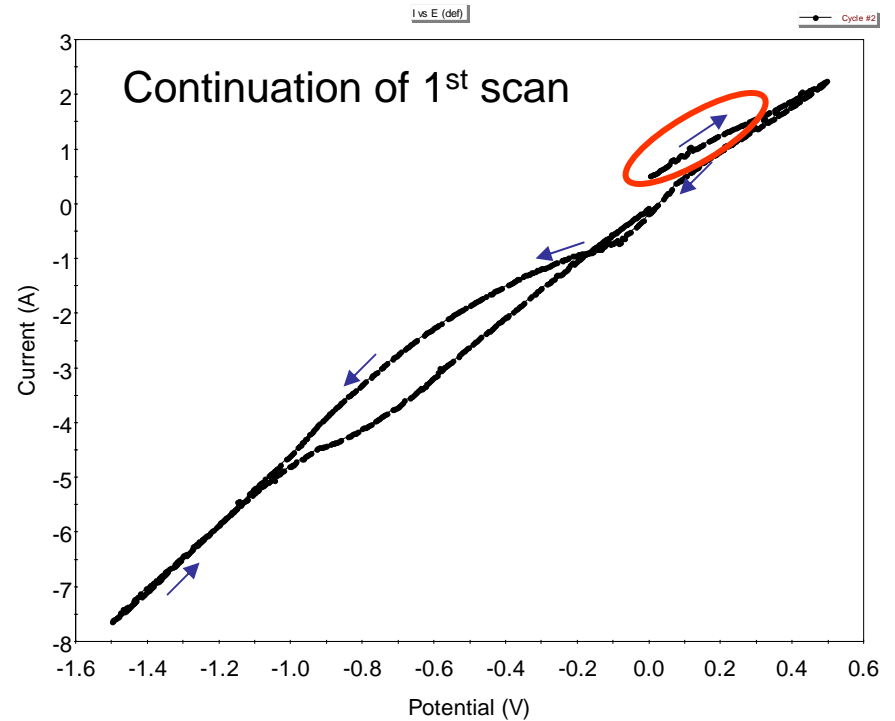
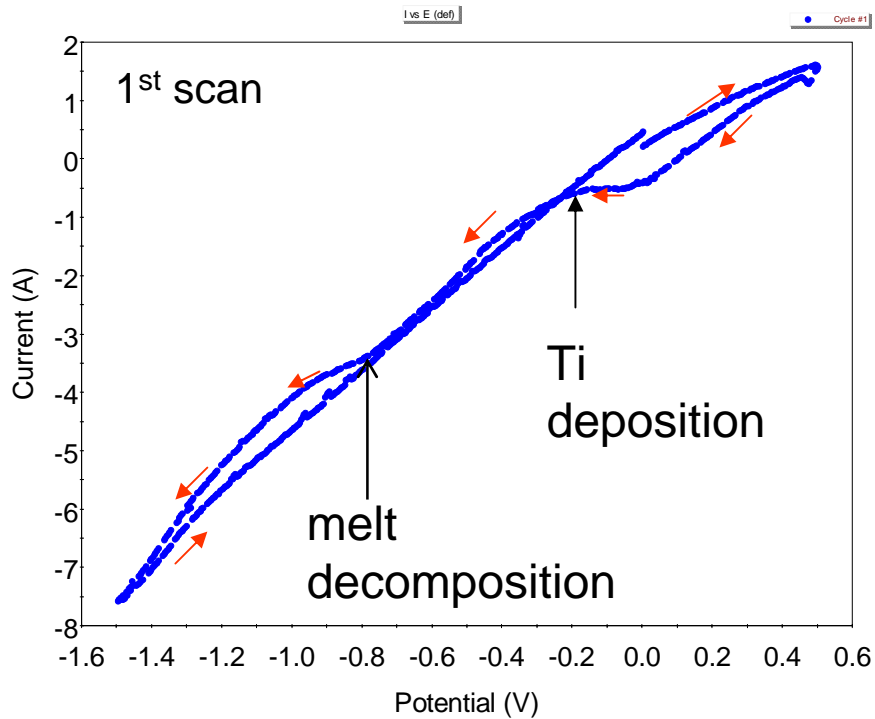
## Mo



## Ti



# CYCLIC VOLTAMMETRY AT 1685 °C



# PRODUCTS

Solid products  
on cathode

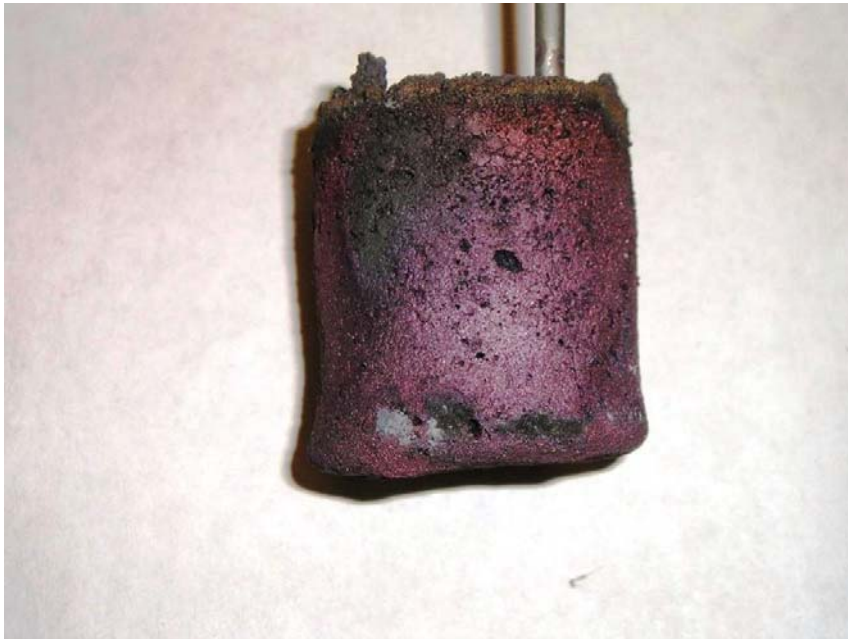


Liquid products on  
bottom



# CARBOTHERMIC REDUCTION ?

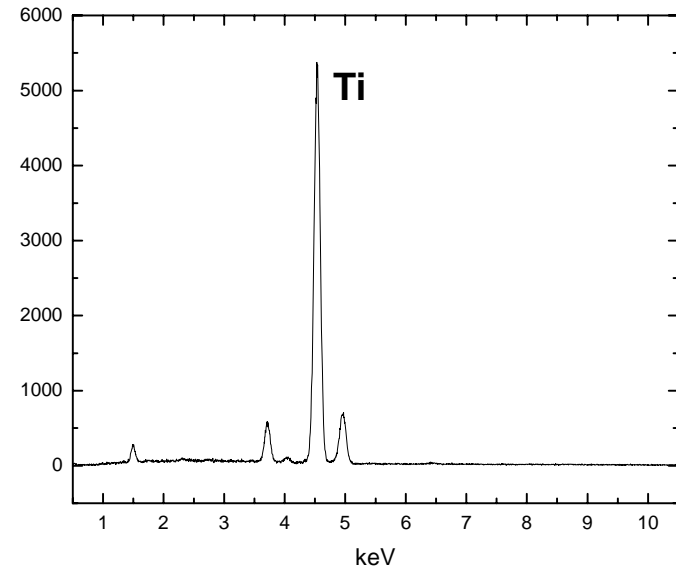
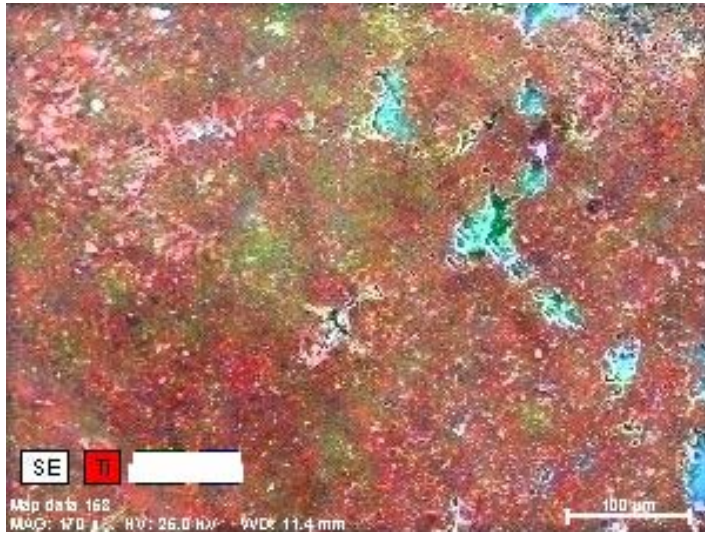
1550 °C



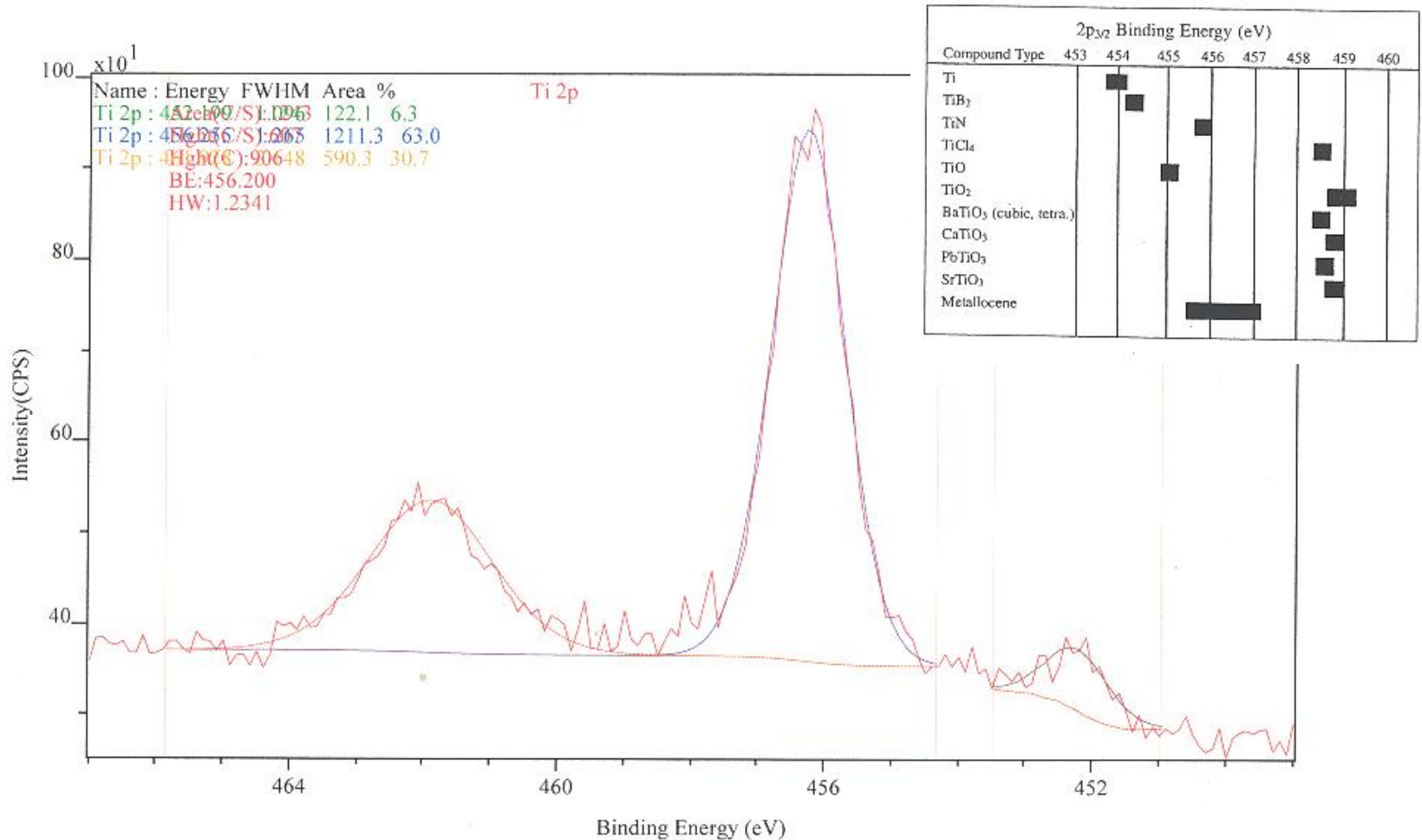
1700 °C



# SEM-EDS Analysis of liquid product on carbon



# XPS-Analysis of liquid product on carbon



# SUMMARY

- Cyclic voltammetry investigation shows that it is possible to reduce titanium dioxide electrochemically in molten oxide electrolytes

楽しいボストン滞在を。

またいらして下さい！