

 论文摘要

中国有色金属学报

ZHONGGUO YOUSEJINSHUXUEBAO XUEBAO

第14卷 第10期 (总第67期) 2004年10月

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文章编号: 1004-0609(2004)10-1752-07

TiO<sub>2</sub>直接电解还原过程的研究

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**摘要:** 采用SEM、EDS、XRD等方法对TiO<sub>2</sub>直接电化学还原产物进行分析, 指出TiO<sub>2</sub>电极的还原是从外向内由高价到低价再到金属逐步进行的。对还原过程中电流、还原气相产物的分析结果表明: 还原过程电流效率低, 并且电流效率随电解时间延续而降低, 阳极产物CO、CO<sub>2</sub>与阴极中间产物Ca发生副反应以及副反应产物炭黑造成电流短路是电流效率低的主要原因。提高电流效率的途径有两条: 一是增大阴、阳极间距, 减小副反应的发生; 二是使电解池表面熔盐不断导出, 或采取某一隔离措施, 使副反应产生的炭黑在阴、阳极之间不造成电流短路。

**关键词:** 电化学还原; 电流效率; TiO<sub>2</sub>

Process of direct electrochemical reduction of TiO<sub>2</sub>

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**Abstract:** The products of electrochemical reduction of TiO<sub>2</sub> were examined by SEM, EDS and XRD. The results show that TiO<sub>2</sub> is reduced step by step from outside to inside and from high valence oxide to low valence oxide until to metal. The analysis of current and anode gases during electrolysis indicates that the average current efficiency is low and decreases with electrolysis time. The secondary reactions between CO, CO<sub>2</sub> and Ca evolved at cathode and short circuit caused by the produced black carbon are the main reasons resulting in low current efficiency. There are two ways to improve the current efficiency. First, the distance between the anode and cathode should be increased enough in order to limit the secondary reaction. Second, the molten salt at the surface should be drained continuously or the anode and cathode should be separated to prevent short circuit caused by black carbon.

**Key words:** electrochemical reduction; current efficiency; TiO<sub>2</sub>

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