

Ba_{1-x}La_xTiO₃陶瓷的晶界再氧化机理研究

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摘要 不同La施主掺杂浓度的BaTiO₃陶瓷在H₂/Ar的还原气氛下烧结后, 再在氧分压P_{O₂}=260Pa的气氛(Ar和O₂的混合气体)下进行氧化, 通过氧流量计检测还原样品在再氧化过程的吸氧行为;

用TEM分析样品氧化后显微结构的变化, 测定了在不同最高氧化温度下氧化样品的PTCR效应以及复阻抗图谱.

结果表明: 氧流量计在升温阶段检测到三个不同行为的吸氧峰, 峰I(起始温度~250℃)为氧空位的填充过程;

峰II(起始温度~800℃)和峰III(起始温度~1250℃)为还原相的氧化过程, 具体来说,

峰II是通过晶界扩散提供氧使靠近晶界附近的区域被氧化; 而峰III是由晶格扩散过程控制,

氧化过程从晶界逐渐向晶粒内部区域扩展, 并伴随着富Ti的Ba₆Ti₁₇O₄₀相的沉淀.

在还原相向氧化相的转变过程中, 于晶界处形成了两个具有晶界势垒的电结构单元而使陶瓷呈现强PTCR效应.

关键词 [掺杂的La钛酸钡陶瓷](#) [晶界再氧化](#) [正温度系数电阻效应](#)

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Mechanism Investigation of Grain Boundary Reoxidation of Barium-lanthanum Titanate Ceramics

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Abstract BaTiO₃ ceramics doped with different La concentrations were sintered under a reducing atmosphere of H₂/Ar (1:99), subsequently, reoxidized in oxygen partial pressure P_{O₂}=260Pa(mixture with Ar and O₂ gas). The behaviour of oxygen in the reoxidation process was investigated by an oxygen coulometry. The microstructure of the raw sintered and reoxidized samples were analysed via TEM. Temperature dependence of resistivity and complex impedance spectroscopy of reoxidized samples at different maximum temperature were measured. Results showed that three oxygen uptake peaks with different onset temperature could be observed during the heating circle. Peak I (onset about 250℃) was attributed to the filling up of oxygen vacancy. Peak II and III were related to the oxidizing of reduced phase. Respectively, Peak II (onset about 800℃) was the formation of oxidized phase at the vicinity of the grain boundaries, which was controlled by grain boundary diffusion. Peak III (onset about 1250℃) was the oxidized phase expanding towards the grain centre and controlled by oxygen bulk diffusion, meanwhile, the rich-Ti phase Ba₆Ti₁₇O₄₀ was precipitated. During the transformation from reduced phase to oxidized phase the development of two potential barriers at grain boundaries resulted in the strong PTCR effect.

Key words [barium-lanthanum titanate ceramics](#) [grain boundary reoxidation](#) [positive temperature coefficient resistance effect](#)

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