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NiCoCrAlYHf/EB-PVD热障涂层的热循环氧化行为

徐前岗[1, 2], 陆 峰[1], 吴学仁[1], 唐建新[1]

(1. 北京航空材料研究院 第五研究室, 北京 100095;
2. 沈阳航空工业学院材料系, 沈阳 110031)

摘 要: 采用电子束物理气相沉积方法(EB-PVD)在NiCoCrAlYHf粘结层上沉积YSZ热障层, 研究了该热障涂层1 100 ℃的循环氧化行为(每个循环为: 1 100 ℃保温30 min、空冷5 min), 分析了粘结层和热生长氧化物的演化过程。结果表明: NiCoCrAlYHf 粘结层氧化初期由β-NiAl和γ固溶体组成, 186次循环氧化后β相/完全转变为γ固溶体。NiCoCrAlYHf/EB-PVD热障涂层中的热生长氧化物包含Al_2O_3层和靠近热障层的尖晶石薄层。该热生长氧化物生长速度较快, 在粘结层的一些富Hf区域优先生长而呈现出明显的不均匀性; 但其具有较大的失效临界热生长氧化物厚度, 失效时热生长氧化物均匀处的厚度约为10 μm。

关键字: 热障涂层; 热生长; 氧化物; 循环氧化

Thermal cyclic oxidation behavior of NiCoCrAlYHf/EB-PVD TBCs

XU Qian-gang[1, 2], LU Feng[2], WU Xue-ren[2], TANG Jian-xin[2]

(1. Laboratory 5, Beijing Institute of Aeronautical Materials, Beijing 100095, China;
2. Department of Materials Science and Engineering, Shenyang Institute of Aeronautical Engineering, Shenyang 110031, China)

Abstract: The cyclic oxidation(30 min hold at 1 100 ℃, 5 min cooled in air) of electron beam physical vapor deposition (EB-PVD) yttria stabilized zirconia thermal barrier coatings(TBCs) on NiCoCrAlYHf bond coat at 1 100 ℃ was investigated. Attention was focused on the development of bond coat and thermally grown oxide(TGO). The result shows that the bond coat is composed of β-NiAl and γ solid solution at the initial stage of cyclic oxidation. The β phase is completely transferred to γ solid solution after 186 cycles. The TGO consists of an Al_2O_3 layer and a thin spinel layer in NiCoCrAlYHf/EB-PVD TBCs. This TGO has a big growth rate and grows irregularly because of selective growth at Hf-riched areas in the bond coat. But the TBCs has a larger critical thickness of TGO for failure. The thickness of TGO at uniform place is about 10 μm when the TBCs fails.

Key words: thermal barrier coating; thermally grown; oxide; cyclic oxidation

地 址：湖南省长沙市岳麓山中南大学内 邮编：410083

电 话：0731-8876765，8877197，8830410 传真：0731-8877197

电子邮箱：f-ysxb@mail.csu.edu.cn