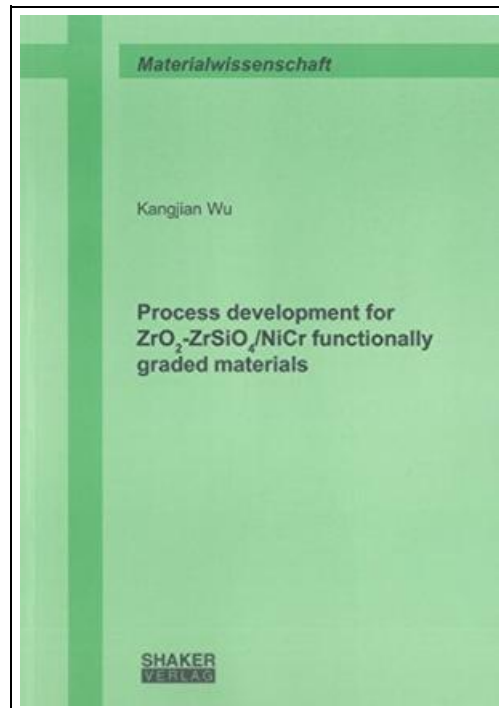


## Process development for ZrO<sub>2</sub>-ZrSiO<sub>4</sub>/NiCr functionally graded materials



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Shaker Verlag Sep 2013, 2013. Buch. Condition: Neu. Neuware - Summary of the work Metal-ceramic functionally graded materials (FGMs) are promising candidates for future high-temperature applications, with the ceramic component offering thermal barrier effects and protecting the metal from melting and oxidation, while the FGMs are strengthened by the metallic component. In previous works, it has been proved that ZrO<sub>2</sub>-ZrSiO<sub>4</sub>/NiCr FGMs of thermal barrier type possess significantly higher oxidation resistance as compared to conventional ZrO<sub>2</sub>/NiCr FGMs. Moreover, it was also found that thermal mismatch stresses in pressurelessly sintered ZrO<sub>2</sub>-ZrSiO<sub>4</sub>/NiCr FGMs vanish at high temperatures. In the present study, further efforts were given with the aim to develop pressureless sintered ZrO<sub>2</sub>-ZrSiO<sub>4</sub>/NiCr FGMs based on two different microstructural concepts. On the one hand, five-layered ZrO<sub>2</sub>-ZrSiO<sub>4</sub>/NiCr FGMs with a stepwise gradient were prepared via slip casting by pressureless sintering with a shrinkage matching process. Shrinkage behavior of the constituent layers of FGM was matched based on the strategy of reducing the mismatches of shrinkage rate between the adjacent layers by a systematic adjustment of the ZrSiO<sub>4</sub> inclusion content and the particle size of ZrO<sub>2</sub> matrix. By utilizing this strategy, ZrO<sub>2</sub>-ZrSiO<sub>4</sub>/NiCr FGMs without any sintering defects were obtained. The prepared FGMs were further investigated with respect to their microstructures, mechanical, thermal properties and high temperature oxidation behavior. Bending strength and Young's modulus of the individual layers of FGM depend not only upon relative density, but also upon phase connectivity of metal and the amount of ZrO<sub>2</sub>/NiCr interface. Coefficients of thermal expansion of the individual layers are lower than calculated theoretical values, due mainly to the relatively low phase connectivity of metal in the metal-ceramic composite layers. The prepared FGMs exhibit superior thermal barrier effects due to the existence of a huge amount of interfacial microstructural defects as thermal resistance in the ceramic-rich side of...

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