https://dspace.org/

The development of a diamond-silicon carbide composite

Mlungwane, Kekeletso

2009-05-08T11:27:55Z
http://hdl.handle.net/10539/6937

Downloaded from a DSpace repository. https://dspace.org/

Table of contents

	Page
Acknowledgements …….	(i)
Preface …….	(ii)
List of figures …….	(v)
List of tables …….	(ix)
Chapter 1: Introduction …….	1
Chapter 2: Literature	
2.1 Materials …….	5
2.2 Infiltration theory …….	8
2.2.1 Non-reactive infiltration …….	10
2.2.2 Reactive infiltration …….	13
2.3 Carbon-Silicon interaction	
2.3.1 Carbon-Silicon reaction …….	17
2.3.2 The wetting of carbon and/or diamond……...	23
2.4 Infiltration behavior of carbon preforms …….	24
2.5 Project motivation…….	27
Chapter 3: Experimental	
3.1 Raw materials and their characterization……..	31
3.1.1 Characterisation of powders …….	32
3.1.2 List of equipment …….	35
3.2 Mixing and milling……	36
3.3 Preparation of preforms…….	37
3.4 Sintering and infiltration……	40
3.5 Diamond/silicon interaction……..	42
3.6 Product analyses……	44
Chapter 4: The wetting behavior and reaction of the diamond/Si system	
4.1 The wetting behavior	
4.1.1 Results ……	47
4.1.2 Discussion ……	52
4.2 Diamond/Si interaction	
4.2.1 Results ……	53
4.2.2 Discussion ……	57
4.3 Conclusion ……	63
Chapter 5: Reaction sintering of diamond and Si powders	
5.1 Results ……	65
5.1.1 Product obtained using uniaxial hot press.……	67
5.1.2 Product obtained using SPS……..	72
5.2 Discussion …….....	73
5.3 Conclusions……	77

Chapter 6: Materials produced by infiltration with Al/Si alloy…… 78
6.1 Results ……. 81
6.2 Discussion ……... 85
6.3 Conclusions ……. 88

Chapter 7: Diamond-silicon carbide composites produced by infiltration with Si
7.1 Preform structure ……. 97
7.2 Infiltration of diamond……... 101
7.3 Mechanical and wear properties of the produced composite……. 105
7.4 Discussion ……... 110
7.5 Conclusions ……... 115

Chapter 8: Summary and conclusions
8.1 The interaction of diamond and Si to form SiC……. 119
8.2 Low pressure production of diamond-SiC composites…….. 120
8.3 Future work ……. 121

Appendix
Calculation of infiltrant flow rates…….. (i)