

(TiB₂)

SHS B₂O₃ TiO₂ TiB₂

/ °C

Al / / B₂O₃ Al

. B₂O₃ TiO₂

SHS (TiB₂) :

Optimization of Synthesizing Conditions for TiB₂ Powder in Aluminothermic Processing Using the Taguchi Experimental Design

B. Shah-Bahrami Malek-e-Ashtar University of Technology, Tehran, Iran

R. Sarraf-Mamoori Tarbiat Modarres University, Tehran, Iran

N. Ehsani Malek-e-Ashtar University of Technology, Tehran, Iran

Abstract

TiB₂ powder was synthesized via simultaneous Aluminum reduction of TiO₂ and B₂O₃ according to SHS reaction in an oxidation atmosphere. This method opposite to other methods, does not need to have controlled atmosphere and high temperature. In this work, Taguchi experimental design was used and different effective parameters and their ranges were studied. Then, the related levels of experiments were determined for Taguchi method and various experiments were carried out based on the determined variation levels. Using statistical calculations, contribution percentage of each parameter was calculated and the most suitable conditions were extracted. Finally, the accuracy experiments were carried out so that the results were corresponded on what obtained from calculations. The most appropriate conditions of synthesis consists of: 1170°C, 0.5 hr, Al and B₂O₃ powder contents 1.194 and 1.124 in stoichiometric ratio, respectively, particle size less than 44 μm for Al powder and between the range of 63 μm to 149 μm for TiO₂ and B₂O₃ powders.

Key words: Titanium Diboride(TiB₂), SHS, Aluminothermic, Taguchi Experimental Design.

PW 1830) XRD (Exciton °C)

ABT SR 50) SEM (Philips

(Topcon

[] []

[]

[]

	(µm)	
> %	F <	(F) Al
> %	< C <	(C) Al
> / %	F <	(F) TiO ₂
> / %	< C <	(C) TiO ₂
> / %	F <	(F) B ₂ O ₃
> / %	< C <	(C) B ₂ O ₃

TiB₂

[-]

(SHS)

TiB₂

[]

Al

Al B₂O₃

TiO₂ B₂O₃

TiB₂

()

(Octagon 200)

cc

[]

)

(

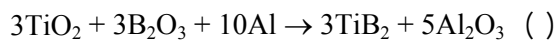
[]

(

(

[]

°C

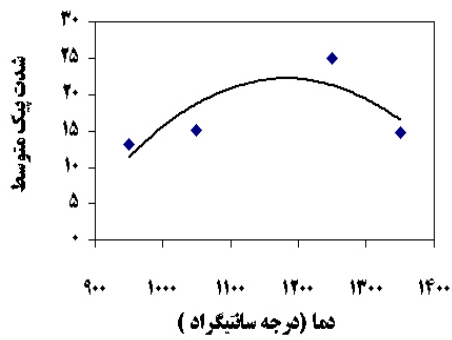


(Fritsch

Pulverisette 6)

- 1- Self propagating high temperature synthesis
- 2- Gasless combustion
- 3- High temperature chain melting

...
L₁₆
-
- -
TiB₂
- - -
TiB₂
- - -
TiB₂
K_{ave})
(

TiB₂

°C

[]

TiO₂

[]

[]

°C

°C

[]

B₂O₃TiB₂

Al	B ₂ O ₃	TiO ₂	
F	C	C	
F	C	F	
C	C	F	
F	F	F	
C	F	F	
C	C	C	
C	F	C	
F	F	C	

C.C.F	F.C.C	F.F.C	F.F.F	(a)
) (
	/		/	()
/	/	/		(b) Al
/	/	/		(b) B ₂ O ₃

:(a)

Al B₂O₃, TiO₂B₂O₃ Al

:(b)

()

Al B₂O₃ TiO₂

() °K

B₂O₃ Al

[]

TiB₂

K -

$$K = (I_{TiB_2} / I_{Total}) \times 100$$

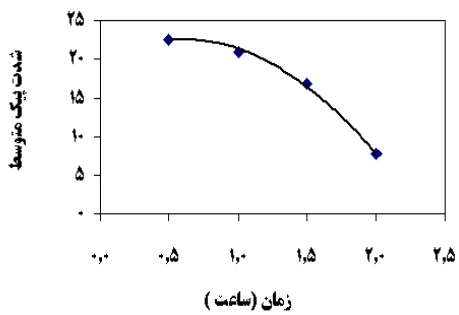
K	() B ₂ O ₃	() Al	()	()		
/	/	/	/		F.F.F	
/	/	/			F.F.F	
/	/	/	/		F.F.F	
/	/	/			F.F.F	
/	/	/			F.F.C	
/	/	/	/		F.F.C	
/	/	/			F.F.C	
/	/	/	/		F.F.C	
	/	/	/		F.C.C	
/	/	/			F.C.C	
/	/	/	/		F.C.C	
	/	/	/		F.C.C	
/	/	/			C.C.F	
/	/	/	/		C.C.F	
/	/	/			C.C.F	
/	/	/	/		C.C.F	

[]

°C

TiB₂

TiB₂



TiB₂

K

/	P _T
/	P _t
/	P _A
/	P _B
/	P _D

B₂O₃

:P_B

:P_T

:P_D

:P_t

Al

:P_A

TiB₂

P_T

()

TiB₂

TiB₂

TiO₂

Al

[]

[]

Al TiO₂

[]

TiB₂

TiB₂

Al

TiB₂

Ti

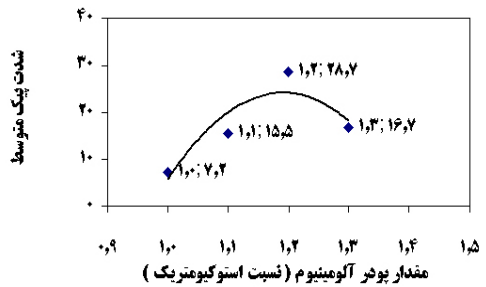
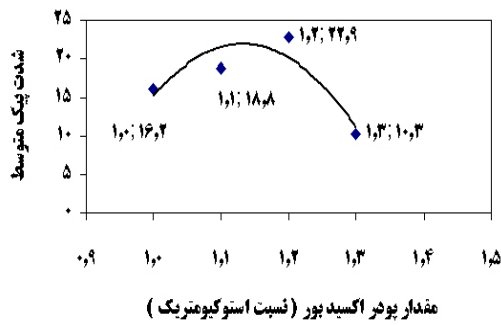
TiO₂

B

TiB₂

Ti Al

/ B₂O₃



TiB₂

Al

() Al

TiB₂

Al

TiB₂

B₂O₃

TiB₂

TiB₂

Al

[]

Al

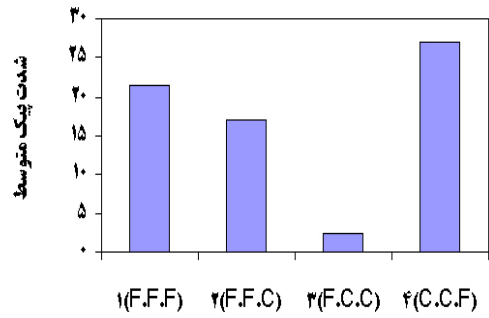
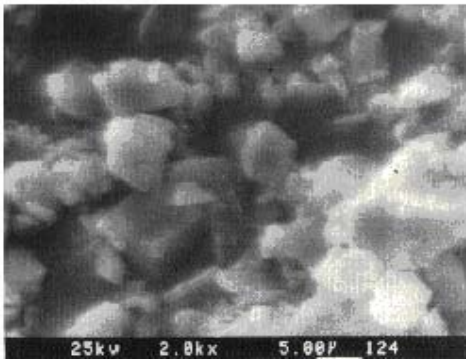
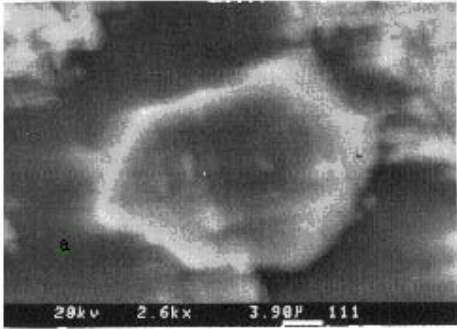
Al₂O₃ Al

(P_A= / %)

c.c.f

[]

/



TiB₂

	()
/	()
/	() Al
/	() B ₂ O ₃
C.C.F	

(a)

(b)

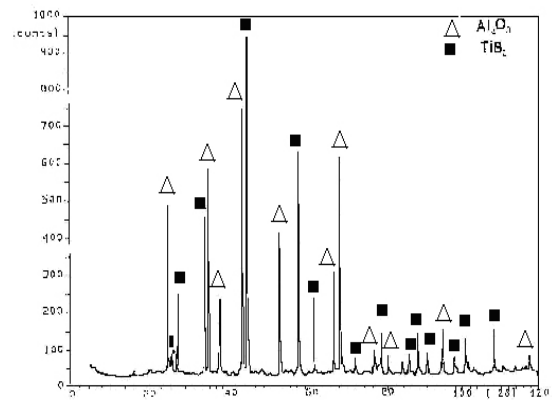
Al₂O₃ TiB₂

(/ %)

K

(XRD)

(SEM)



TiB₂

°C

SHS

TiB₂

B₂O₃ Al

TiB₂

B₂O₃

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- TiB₂ Al -
B₂O₃ TiO₂ .
TiB₂
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