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MODIFIED SILICON-CARBIDE CERAMICS BASED ON NANOHAFNIUMCARBOSILANES

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The regularities of the formation of ceramic phases of silicon carbide modified by hafnium compounds during the thermal transformation of nanohafniumcarbosilanes (I) under various conditions were investigated. It is found that the thermochemical transformation of nanohafniumcarbosilanes at 1500 °C in different media (nitrogen, argon, air, vacuum) leads to the formation of ceramics, which differs not only in chemical composition but also in surface morphology.

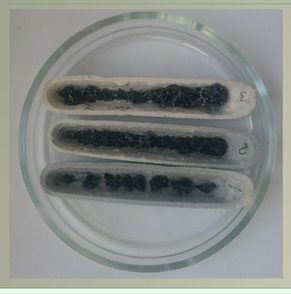
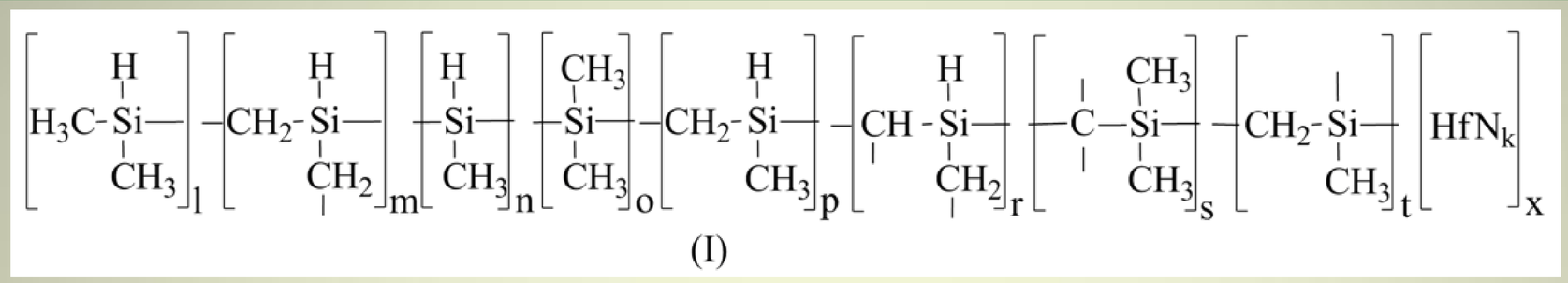
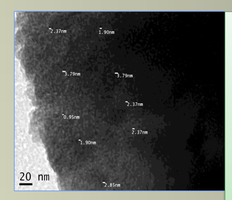


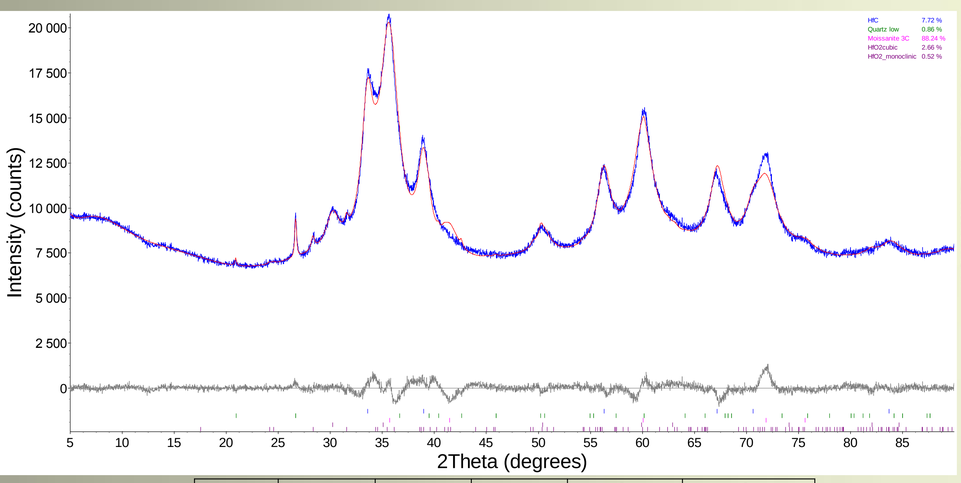
Foto of the ceramics of n-HfOCS

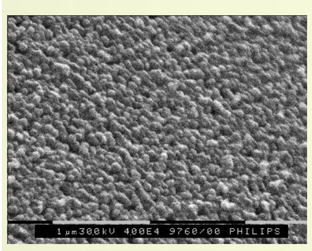


$$\xrightarrow[\text{Ar, } N_2\text{, Air, vacuum}]{1500\ ^0C} + SiC(Hf) + CH_4\uparrow + H_2\uparrow + C_2H_4\uparrow + C_2H_6\uparrow$$



TEM of the ceramic of n-HfOCS pyrolysis in argon up to 1500 °C

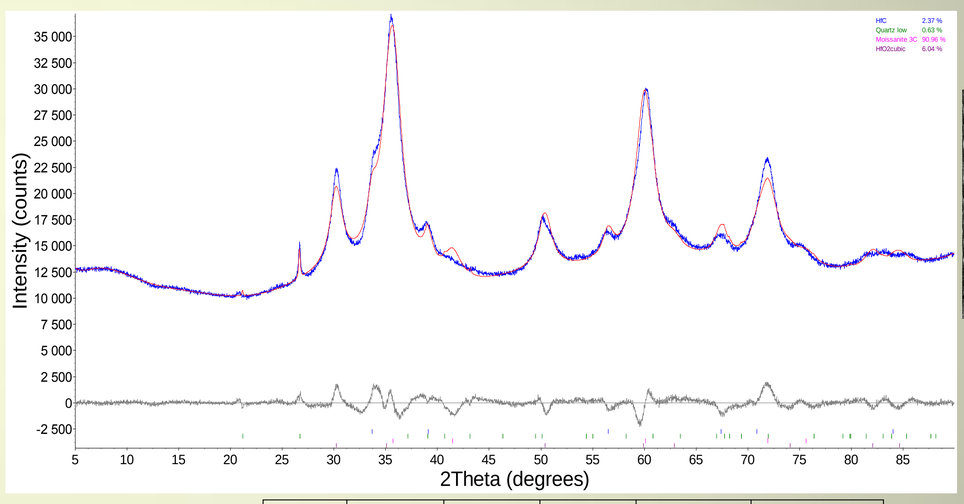


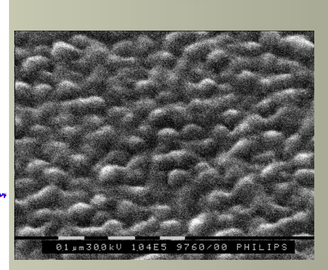


Element	Wt%	At%
C K	21.03	43.03
O K	05.80	08.91
HfM	21.65	02.98
SiK	51.53	45.09

A

№	HfC	Quartz	SiC	HfO_2 (cubic)	HfO_2 (monoclinic)
A	7.7(5)	0.86(4)	88.2(7)	2.7(2)	0.52(6)



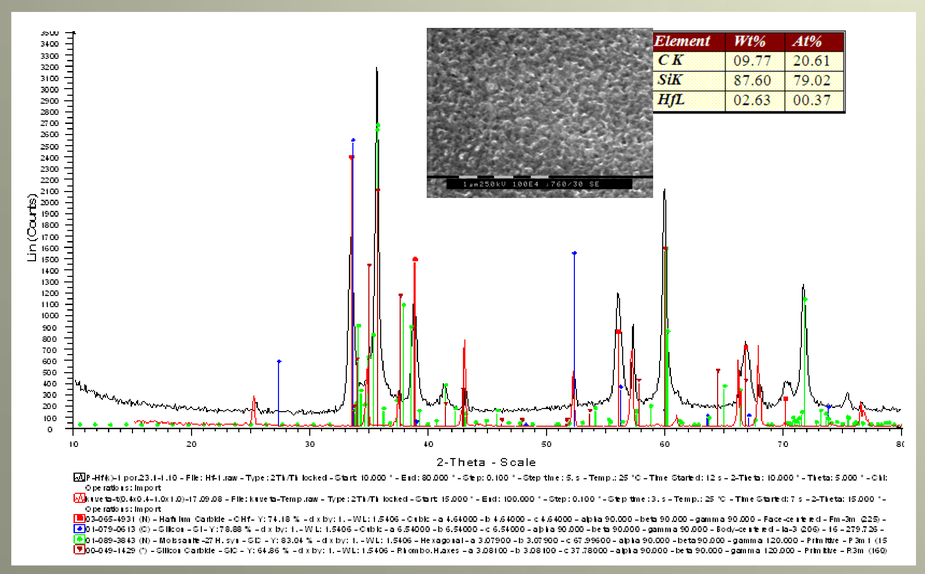


Element	Wt%	At%
C K	11.50	25.45
O K	05.18	08.61
HfM	16.21	02.41
SiK	67.11	63.53

B

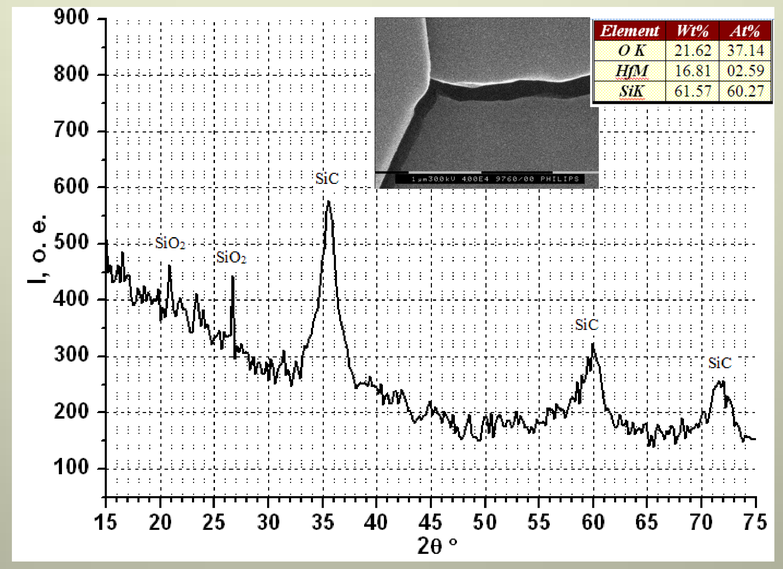
№	HfC	Quartz	SiC	HfO_2 (cubic)	HfO_2 (monoclinic)
B	2.4(3)	0.63(4)	91.0(8)	6.0(6)	—

X-ray diffraction pattern of a ceramics 1500 °C (A – in argon; B – in nitrogen) produced from a n-HfOCS: (*1*) calculated profile, (*2*) raw data, (*3*) difference plot



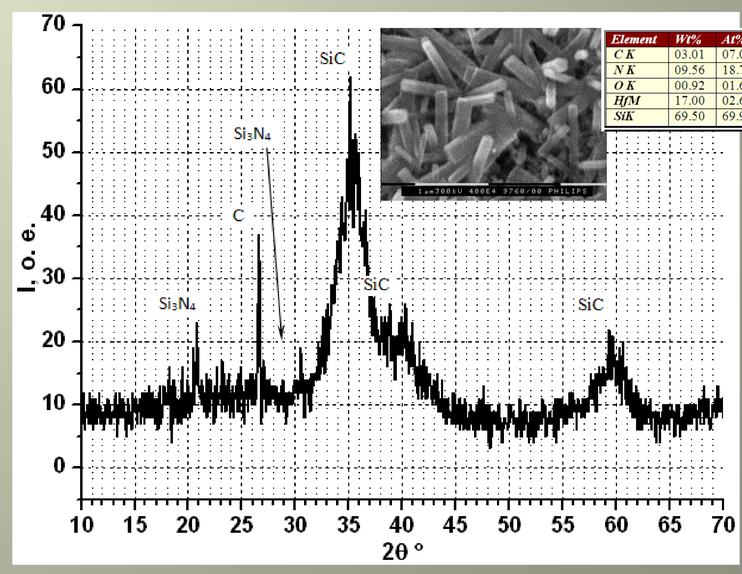
Element	Wt%	At%
C K	09.77	20.61
SiK	87.60	79.02
HfL	02.63	00.37

X-ray diffraction pattern of a ceramics produced from a n-HfOCS 1500 °C in a vacuum: basic phases – HfC and β-SiC



Element	Wt%	At%
O K	21.62	37.14
HfM	16.81	02.59
SiK	61.57	60.27

X-ray diffraction pattern of a ceramics produced from a n-HfOCS 1500 °C in air: basic phases – SiO_2 and SiC



Element	Wt%	At%
C K	03.01	07.07
N K	09.56	18.72
O K	00.92	01.63
HfM	17.00	02.69
SiK	69.50	69.90

X-ray diffraction pattern of a ceramics produced from a n-HfOCS (Hf > 10 wt. %) 1500 °C in nitrogen: phases – SiC and Si_3N_4 (nierite)