

New high-entropy ceramics carbides (HECCs) based on Nb, Ti, Zr and Hf

Monika K. Krawczyk¹, Robert Konieczny¹, Dorota Podsiadła¹, Rafał Idczak¹, Piotr Sobota¹, Wojciech Nowak¹

¹*Institute of Experimental Physics, University of Wrocław, M. Bornha 9, Wrocław, 50-204, Poland*

monika.krawczyk@uwr.edu.pl

High-entropy ceramics (HECs) are solid solutions usually containing four, five or more metals mixed in equimolar or almost equimolar ratios that exhibit a high configuration entropy, see for example [1,2]. A subgroup of HEC materials are high-entropy carbides ceramics (HECCs), which are intensively studied due to their properties. Materials of this class are ceramics with ultra-high melting points (ultra-high temperature ceramics), reaching temperature above 3000 °C and characterized by exceptional thermal and chemical stability, good resistance to oxidation and corrosion [3, 4]. Hence, HECCs are attractive due to their potential application related to thermal protection, for example in technologies such as hypersonic vehicles, engines, nuclear reactors, furnace components, thermal barrier coatings or thermoelectrics [3,5,6]. Moreover, HECC materials can also exhibit superconductivity, as shown in the ceramics of the formulas: $(\text{Ti}_{0.2}\text{Zr}_{0.2}\text{Nb}_{0.2}\text{Hf}_{0.2}\text{Ta}_{0.2})\text{C}$ [7] and $\text{Ti}_{0.2}\text{Zr}_{0.2}\text{Nb}_{0.2}\text{Mo}_{0.2}\text{Ta}_{0.2}\text{C}_x$ ($x = 1$ and 0.8) [8]. In our studies, we synthesized HECC materials based on metals such as Nb, Ti, Zr, Hf, which were subjected by the powder X-ray diffraction (PXRD) and magnetization studies. Analysis of the diffraction patterns of the obtained products was performed using the Rietveld refinement method that revealed the face-centered cubic structure (fcc), space group $Fm\bar{3}m$. The properties of studied ceramics will be compared with the corresponding data reported for other HECC materials.

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