SYNTHESIS OF HAFNIUM-BASED MAX PHASES BY MAGNETRON SPUTTERING

D.ZELENTSOV, S. DEMCHENKO, S.ZENKIN

Tomsk Polytechnic University, Lenina 30, Tomsk, 634034, Russia, z-denis07@mail.ru, 89528947238

The special practical interest from the point of view of creating materials for the future application in mechanical engineering is caused by the so-called MAX materials, due to the unique properties of these materials, combining metallic (strength, high electrical and thermal conductivity, manufacturability) and ceramic (refractory, high Young's modulus, high microhardness) properties [1]. First, the applicability of these class of materials to high temperature applications is due to the combination of thermal shock and oxidation resistance, high thermal and electrical conductivity. In this case, the new hafnium based MAX phases (such as Hf_2AlC, Hf_3AlC_2) may be good candidates to application for thermal barrier coatings (TBC).

One of the common method for coating preparation is magnetron sputtering. For now, information of obtaining hafnium based MAX phases by this method in literature is very little, so aim of this study was directed to selection of optimal parameters of magnetron sputtering and research their physical (thermal and electrical conductivity, thermal expansion), mechanical (micro- nanohardness) properties, and also chemical composition of obtained coating.

For experimental implementation were held several experimental stages: sputtering from two targets (Al, Hf) in $Ar+CH_4$ atmosphere to unheated substrate and subsequent annealing of samples in inert atmosphere up to 1000^oC and sputtering with heated substrate ($T = 400 - 1000^oC$). Aluminum concentration was controlled by Al target discharge current. In all experiments the pressure of argon $+CH_4$ was constant with the value 10^{-2} Torr. After that, samples were investigated by XRD for identification of present phases, by laser flash analysis for thermal conductivity, and four point probe method resistivity measurement for electrical conductivity. To investigate phase transformations in samples while heating we use thermogravimetric analysis.

REFERENCES

[1] *M.W. Barsoum* // Progress in Solid State Chemistry. -2000. -28. -201-281.