Contribution ID: **995** Type: **Oral**

Investigation of the radiation resistance and optical properties of new composite thermal barrier coatings.

Tuesday, 25 October 2022 14:45 (15 minutes)

Improved thermal barrier coatings (TBCs) will enable future gas turbines to operate at higher gas temperatures [1]. Considerable effort is being invested, in identifying new materials with even better performance than the current industry standard, yttrium stabilized zirconia (YSZ) [2]. Turbines should operate at as high temperature as possible to maximize their efficiency. Until about 15 years ago, relentless increases in operating temperatures were achieved through improved alloy design, the development of blades composed of textured microstructures and subsequently single crystals, and internal cooling by air flow through internal channels cast into the component. More recently increase in operating temperatures have been enabled by deposition of TBCs on high-temperature gas turbine components. Rare-earth silicates have been identified as a class of low-thermal conductivity ceramics for possible use in TBCs for gas-turbine engine applications. They are also supposed to be applied in spacecrafts as protective layer against heat. The operation of spacecrafts in cosmic conditions in turn suggests long-lasting irradiation with cosmic rays, particularly with MeV energy range protons, electrons and neutrons [3]. Therefore, it is very important to investigate the behavior of such barrier coatings under irradiation conditions. The aim of our work is to investigate the radiation resistance of TBCs based on silicate compounds obtained by a new method (hydrothermal microwave) by using high-energy electron, proton and neutron beam irradiation. For this purpose various silicates prepared by hydrothermal microwave method were irradiated with 20 MeV electrons, l8 MeV protons and neutron with doses 1013-1017 particle/cm2. The diffuse reflectance and absorption measurements of materials before and after irradiation indicated that the samples have a high radiation resistance. X-ray diffraction analysis (XRD) suggested that the samples after proton and neutron irradiation maintain the crystalline structure.

[1] V. Kumar and B. Kandasubramanian, "Processing and design methodologies for advanced and novel thermal barrier coatings for engineering applications,"Particuology, vol. 27, pp. 1–28, 2016, doi: 10.1016/j.partic.2016.01.007.
[2] Z. Tian, L. Zheng, J. Wang, P. Wan, J. Li, and J. Wang, "Theoretical and experimental determination of the major thermo-mechanical properties of RE2SiO5 (RE=Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y) for environmental and thermal barrier coating applications,"J. Eur. Ceram. Soc., vol. 36, no. 1, pp. 189–202, 2016, doi: 10.1016/j.jeurceramsoc.2015.09.013.
[3] V.V. Baghramyan, A.A. Sargsyan, N.B. Knyzyan, V.V. Harutyunyan, A.H. Badalyan, N.E. Grigoryan A. Aprahamian, K.V. Manukyan (2020). Pure and cerium doped zinc orthosilicate as a pigment for thermoregulating coating, Ceramics International, Volume 46, Issue 4, 2020, pp. 4992-4997.

Primary authors: BADALYAN, Anush (Armenian); HARUTYUNYAN, Vachagan (A. Alikhanyan National Laboratory); ALEKSANYAN, EDUARD (A. Alikhanian National Laboratory); Mr GRIGORYAN, Norik (Armenian); Mrs ARESTAKYAN, Arevik (Armenian); ARZUMANYAN, Vika (A. Alikhanyan National Laboratory); Mr BAGHRAMYAN, Volodya (Armenian); Mrs SARGSYAN, Anahit (Armenian); CULICOV, Otilia Ana (JINR); BOBRIKOV, Ivan (JINR)

Presenter: BADALYAN, Anush (Armenian)

Session Classification: Condensed Matter Physics

Track Classification: Condensed Matter Physics