Obtainment and Characterization of Aluminum Alloy Quasicrystalline Verging Coating by Flame Spray

T. M. Silva-1[1,*,#], W. Wolf-2[2], W. J. Botta-3[2], G. R. Santos-4[1], B. B. Medeiros-5[1,*]

[1]Federal University of Technology - Paraná, Pato Branco, Brazil.
[2]Federal University of São Carlos, São Carlos, Brazil.

[#]Corresponding author: contatotiagom@gmail.com

The thermal barrier coatings (TBC) are coatings that seek to change the surface properties of components through the use of materials which have low thermal conductivity, high melting point and good mechanical properties at high temperatures[1]. Therefore, looking for improve efficiency and reduce maintenance costs, these coatings are applied mainly in gas turbines and diesel engines[2]. The quasicrystals, duo to their properties of low thermal conductivity and a thermal expansion coefficient that is close to the most common metals substrates[3], are good candidates to replace the usual ceramics that often fail prematurely in the coating due to differences in thermal expansion coefficient between the coating and the metal substrate. Thus, this study shows the analysis of the coatings obtained by thermal spraying method of atomized powders $Al_{71}Co_{13}Fe_8Cr_8$ alloy, a quasicrystalline verging, with the physical and transport properties presented by the quasicrystalline phase, on substrates of a steel 1020 alloy and an aluminum 4032 alloy. Moreover, it was also studied the application of UltraBond 25000, a commercial Nickel-based bond coat alloy, to study an improvement in adhesion. The coating's microstructure analysis showed some porosity and concentration of oxides. In the XRD analysis the expected phases Al_5Co_2 and $Al_{13}Co_4$ were found, besides the $Al_{3,21}Si_{0,47}$, nickel-fcc and aluminum-fcc phases. The samples presented ideal adherence in the folding test, with the exception of the samples with substrate of the aluminum 4032 alloy without application of UltraBond 25000 alloy. Regarding the Vickers microhardness, the coating presented the highest values expected, even higher than the literature. In the tensile adhesion test it was verified the improvement in adhesion with the use of the UltraBond 25000. The relative thermal insulation capacity of the coating was confirmed by thermal tests.

[1] J. P. Oliveira, J. F. Duarte, Cerâmica. **59**, (2013) 186-191.

[2] N. P. Padture, M. Gell, E. H. Jordan, Science. **296**, (2002) 280-284.

[3] J.-M. Dubois, Materials Science and Engineering. **294-296**, (2000) 4-9.