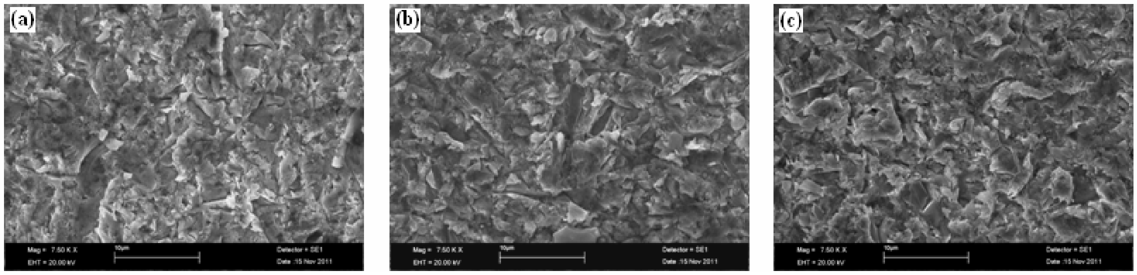

Figure 5. SEM micrograph of the wear track on the CoNiCrAlY coatings; (a) APS- CoNiCrAlY coatings, (b) HVOF- CoNiCrAlY coatings, (c) CGDS- CoNiCrAlY coatings

4. Conclusions

This study has investigated the wear performance and microstructural characterization of CoNiCrAlY bond coatings that were produced by APS, HVOF and CGDS, respectively.

The major results are summarized as follows:

1) Specimen produced with CGDS method show the highest surface hardness among the specimen and specimen produced with HVOF and APS method follow it respectively.
2) The highest roughness value is seen at the coating specimen produced with CGDS method and coating specimens produced with HVOF and APS methods follow it respectively. When the wear performances of coating systems during the early states are evaluated, CGDS coatings are seen to have lower performance than coatings produced with HVOF and APS methods. This situation is the result of surface roughness effect's being the operative mechanism in the erosion's starting period. Because of the loss of surface roughness effect depending on erosion, dense structure and high hardness of coating layer, CGDS coatings show the best performance in abrasion performances in progressive processes of wear (last state and later on).
3) The lowest volume loss is seen in coating specimen produced with CGDS method among the specimens and specimen that are abraded with HVOF and APS follow it respectively.

References

[1]. P. Cosemans, X. Zhu, J.P. Celis, M. Van Stappen, Development of low friction wear-resistant coatings, Surface and Coatings Technology 174 –175 (2003) 416–420.
[2]. R.G. Bonora, H.J.C. Voorwald, M.O.H. Cioffi, G.S. Junior, L.F.V. Santos, Fatigue in AISI 4340 steel thermal spray coating by HVOF for aeronautic application, Procedia Engineering 2 (2010) 1617–1623.
[3]. J.F. Li, H. Liao, X.Y. Wang , B. Normand , V. Ji , C.X. Ding , C. Coddet, Improvement in wear resistance of plasma sprayed yttria stabilized zirconia coating using nanostructured powder, Tribology International 37 (2004) 77–8.
[4]. S. Wilson; D. Sporer; M. R. Dorfman, Technology Advances in Compressor and Turbine Abradables, ITSC 2008, 330-335.
[5]. E. Lugscheider, J. Zwick, Aachen/D, M. Hertter, München/D, and D. Sporer, Sonthofen/D, Control of Coating Properties of Abradable Seals by On-Line Process Diagnostics, International Thermal Spray Conference 2005, Thermal Spray connects: Explore its surfacing potential, Basel, Switzerland, May 2 - 4, 2005, 610-614.
[6]. A.C. Karaoglanli, E. Altuncu, I. Ozdemir, A. Turk, F. Ustel Structure and durability evaluation of YSZ+Al_2O_3 composite TBCs with APS and HVOF bond coats under thermal cycling conditions. Surface & Coatings Technology 205 (2011) 369–373.
[7]. P. Richer , M. Yandouzi, L. Beauvais, B. Jodoin, Oxidation behaviour of CoNiCrAlY bond coats produced by plasma, HVOF and cold gas dynamic spraying, Surface & Coatings Technology 204 (2010) 3962–3974.
[8]. W. Brandl, D. Toma, H.J. Grabke, The characteristics of alumina scales formed on HVOF-sprayed MCrAlY Coatings, Surface and Coatings Technology 108–109 (1998) 10–15.
[9]. I. Burlacov, J. Jirkovsky, L. Kavan, R. Ballhorn, R.B. Heimann, Cold gas dynamic spraying (CGDS) of TiO2 (anatase) powders onto poly(sulfone) substrates: Microstructural characterisation and photocatalytic efficiency, Journal of Photochemistry and Photobiology A: Chemistry 187 (2007) 285–292.
[10]. L. Ajdelsztajn, B. Jodoin, J.M. Schoenung, Synthesis and mechanical properties of nanocrystalline Ni coatings produced by cold gas dynamic spraying, Surface & Coatings Technology 201 (2006) 1166–1172.
[11]. K.I. Schiffmann, R. Bethke, N. Kristen, Analysis of perforating and non-perforating micro-scale abrasion tests on coated substrates, Surface & Coatings Technology 200 (2005) 2348– 2357.
[12]. D.B. Luo, V. Fridrici, Ph. Kapsa, Relationships between the fretting wear behavior and the ball cratering resistance of solid lubricant coatings, Surface & Coatings Technology 204 (2010) 1259–1269.
[13]. Y Kusano, K Van Acker, I.M. Hutchings, Methods of data analysis for the micro-scale abrasion test on coated Substrates, Surface and Coatings Technology 183 (2004) 312–327.