

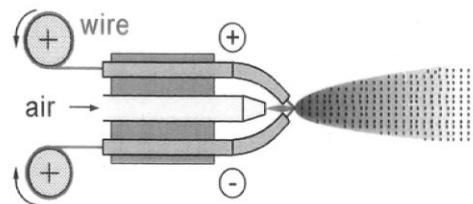
MICROESTRURAS DE REVESTIMENTOS DEPOSITADOS PELOS PROCESSOS DE ASPERSÃO TÉRMICA

Ramón S. Cortés Paredes
Departamento de Engenharia Mecânica da UFPR
ramon@ufpr.br

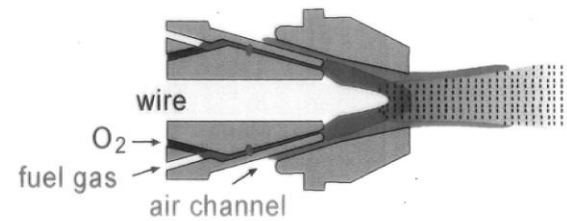


Thermal Spray Processes

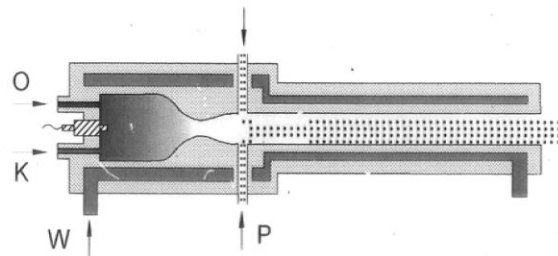
wire arc spraying



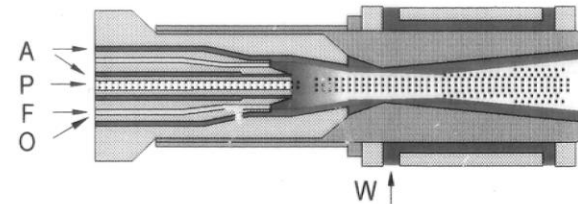
flame spraying (wire)



HVOF : JP-5000

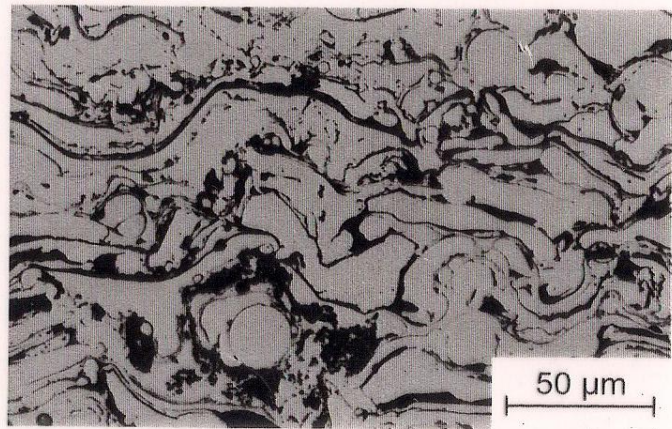
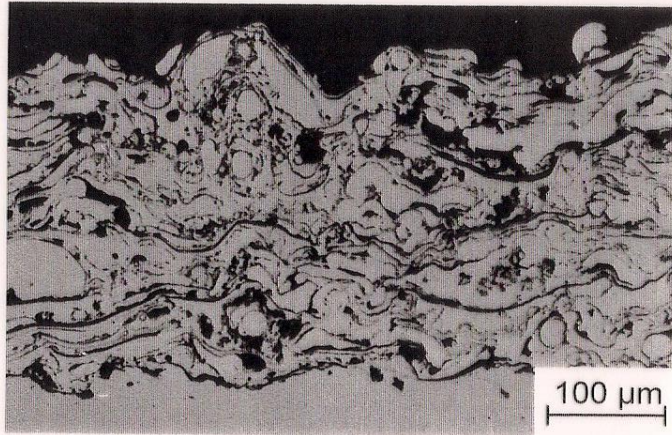


HVOF : DJ 2600, DJ 2700

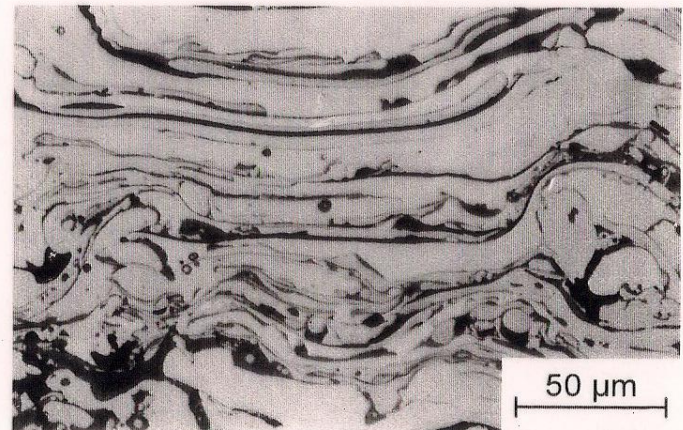
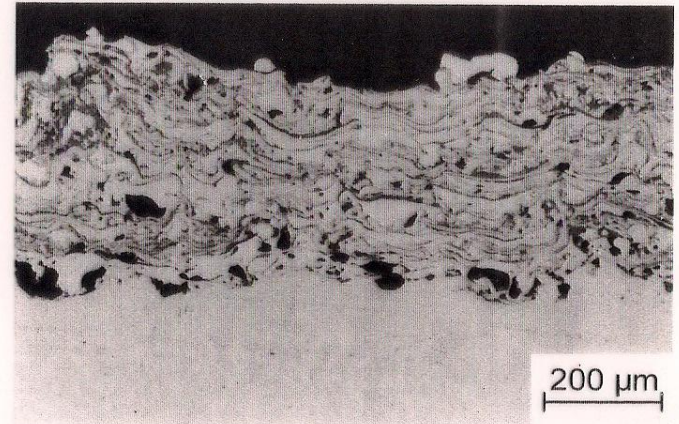


Microstructure of Thermal Spray Coatings (13 Cr-Steel)

arc sprayed

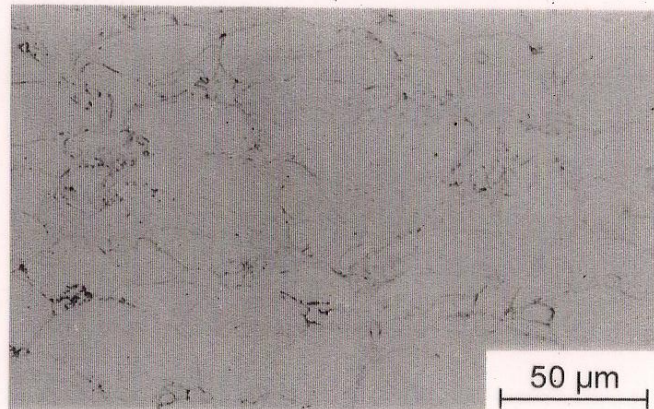
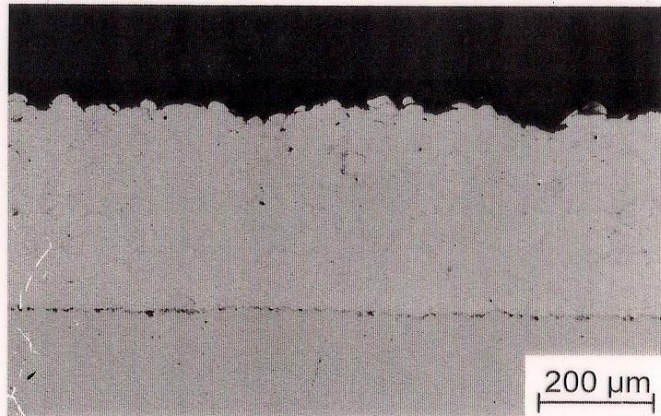


flame sprayed

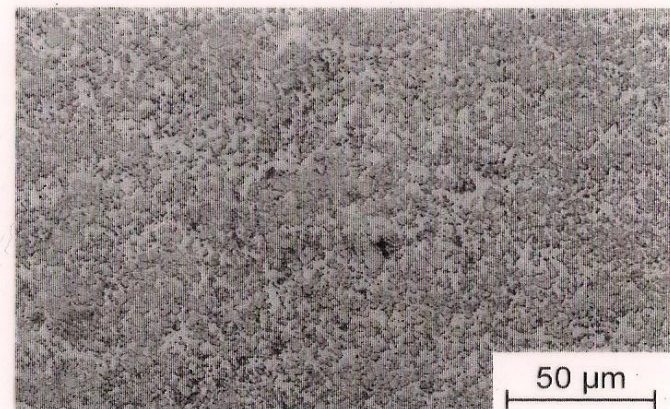
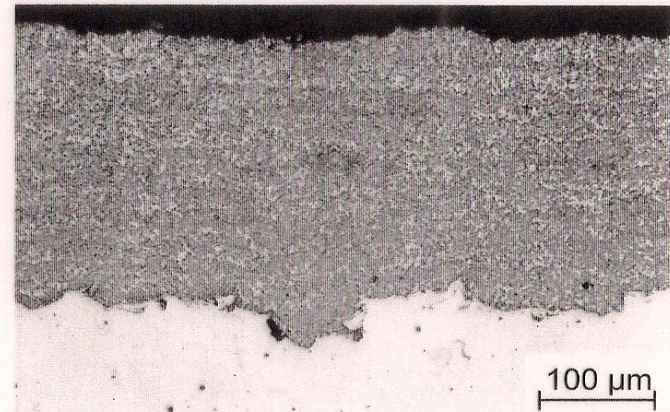


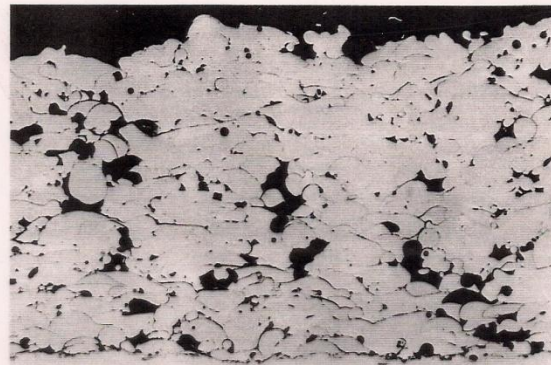
Microstructure of Thermal Spray Coatings (HVOF)

stainless steel 316 L JP-5000 / kerosene



WC-Co 83-17 DJ 2700 / ethylene





1190/18

100x



1190/19

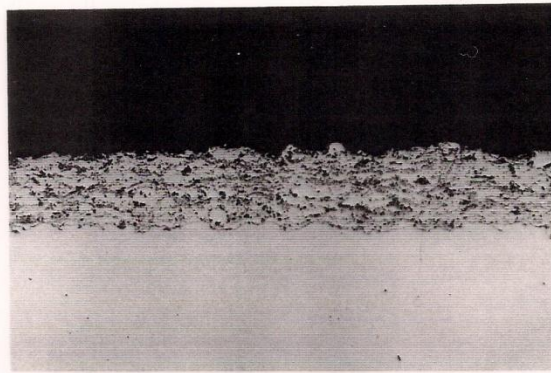
200x



1190/20

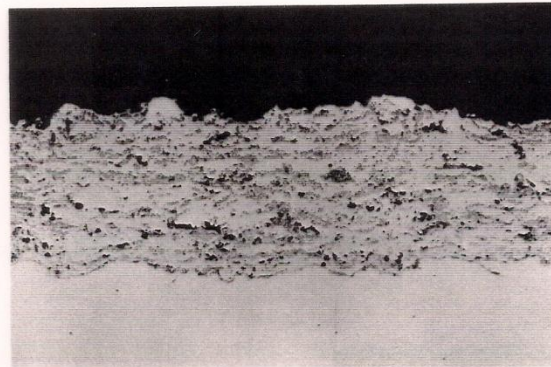
500x

Bild 5a: Gefüge der NiCrBSi-Schicht (T5.2, konventionelles Flamspritzen) / FS pó



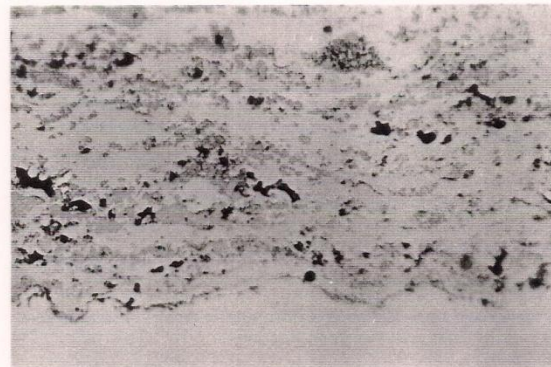
1202/20

100x



1202/21

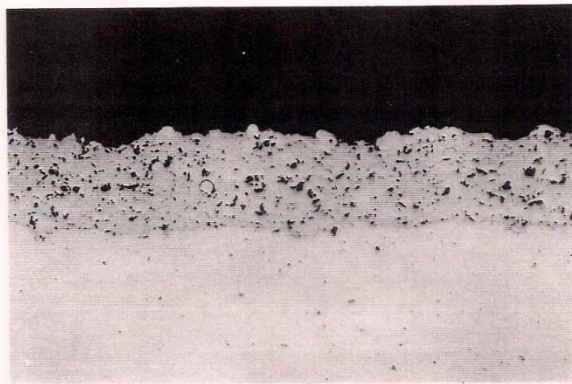
200x



1202/23

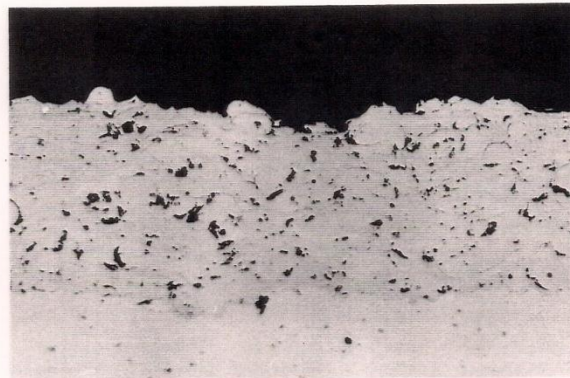
500x

Bild 3a: Gefüge der NiCrBSi-Schicht mit 50% WC-Co
(T3.2, HVOF)



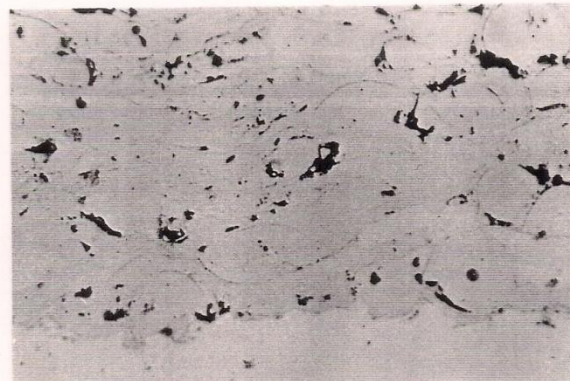
1190 / 11

100x



1190 / 12

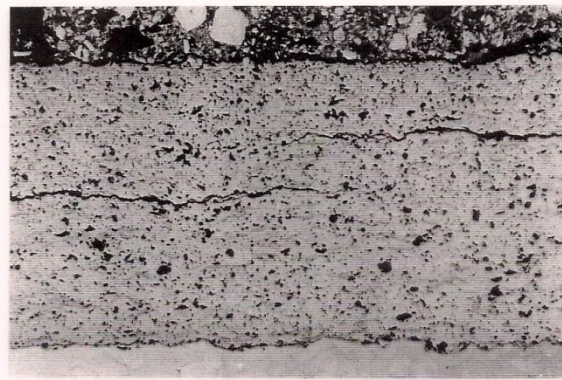
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1190 / 13

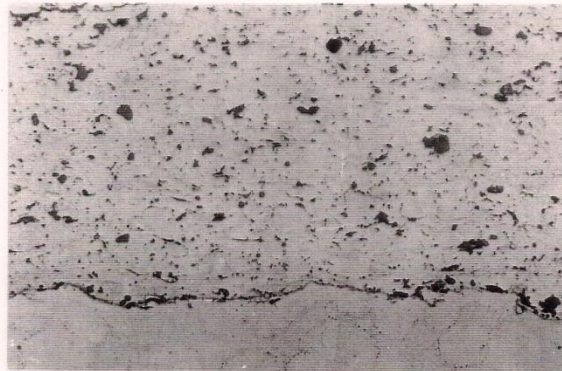
500x

Bild 2a: Gefüge der NiCrBSi-Schicht (T21, HVOF)



1203/24

100x



1203/25

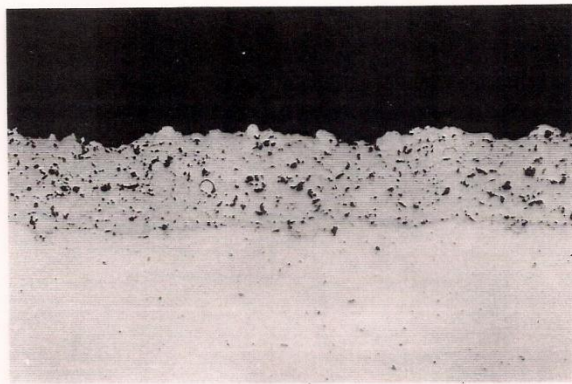
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1203/27

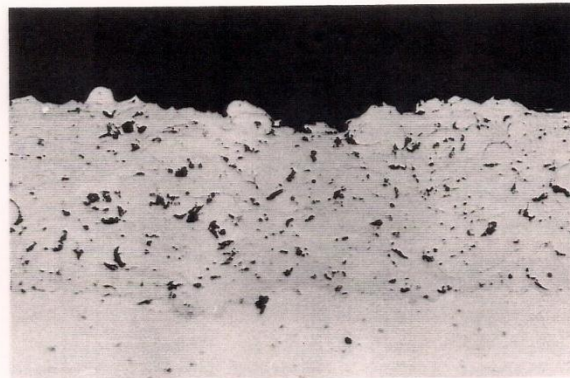
500x

Bild 4a : Gefüge der Al_2O_3 -Schicht , kontrastiert
(T4.1, Plasmaspritzen)



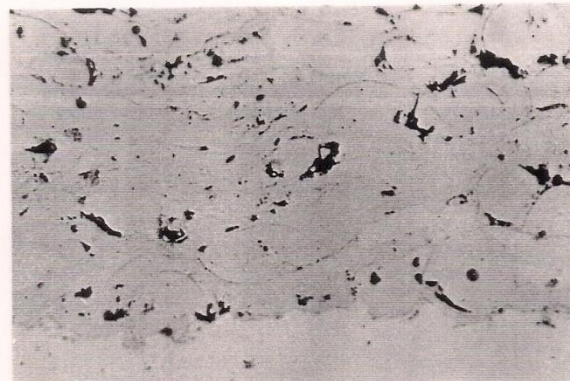
1190 / 11

100x



1190 / 12

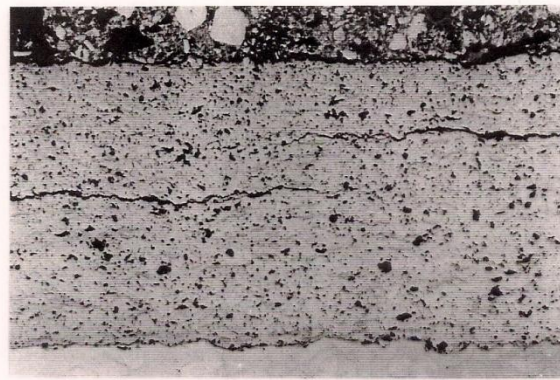
200x



1190 / 13

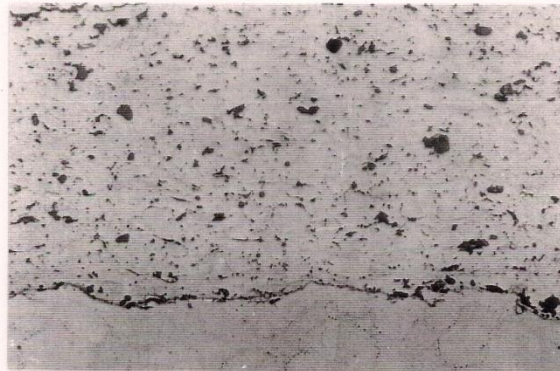
500x

Bild 2a: Gefüge der NiCrBSi-Schicht (T21, HVOF)



1203/24

100x



1203/25

200x



1203/27

500x

Bild 4a : Gefüge der Al_2O_3 -Schicht , kontrastiert
(T4.1, Plasmaspritzen)

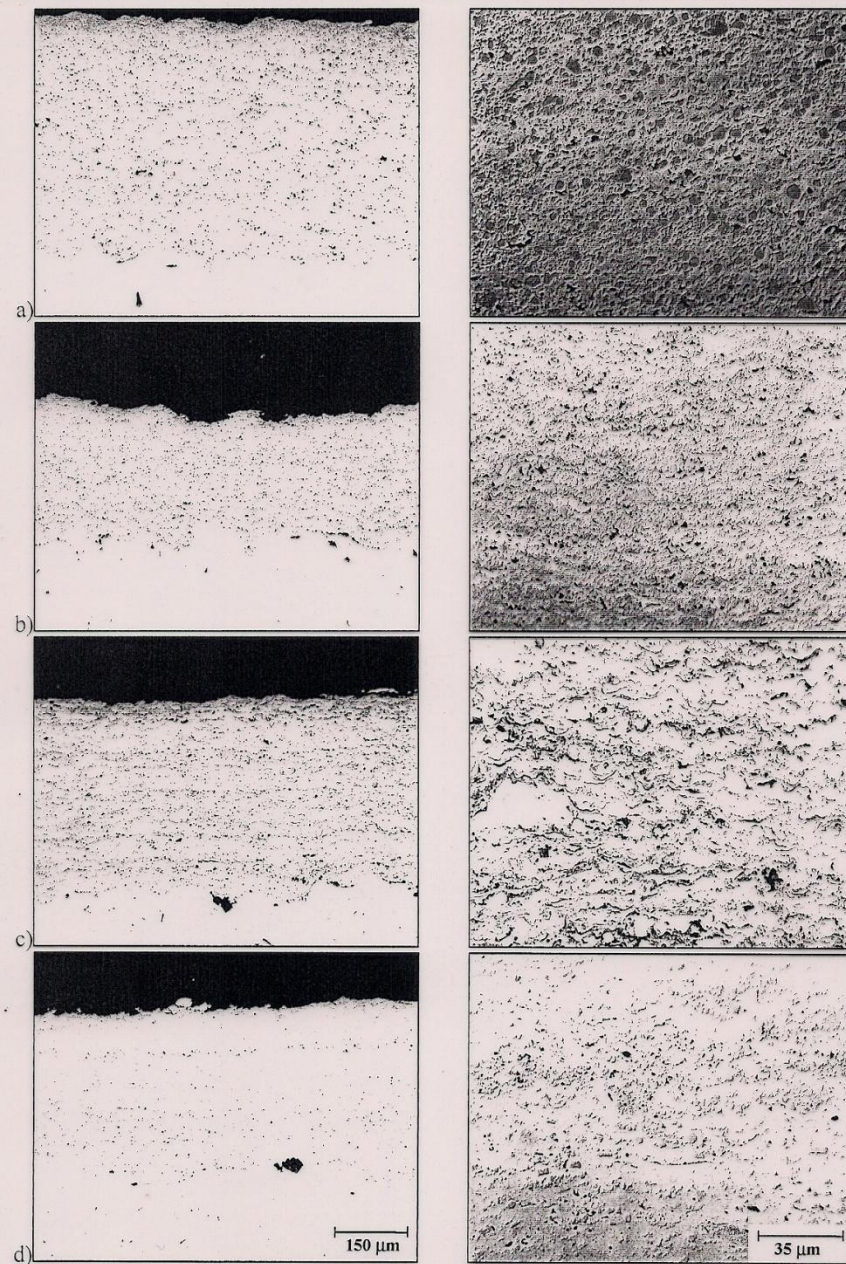


Figura 4.5 – Imagens do MO mostrando camadas, 200x e 1000x - pistola DJ 2700

a) M1, WC-17Co, -53+11 μm, aspergido sinterizado

b) M2, WC-10Co-4Cr, -53+11 μm, aglomerado sinterizado

c) M3, Cr_3C_2 -25(Ni 20Cr), -45+5.5 μm, misturado

d) M4, (WC-12Co) 33Ni 9Cr 3,5Fe 2Si 2B 0,5C, -45+11 μm, misturado

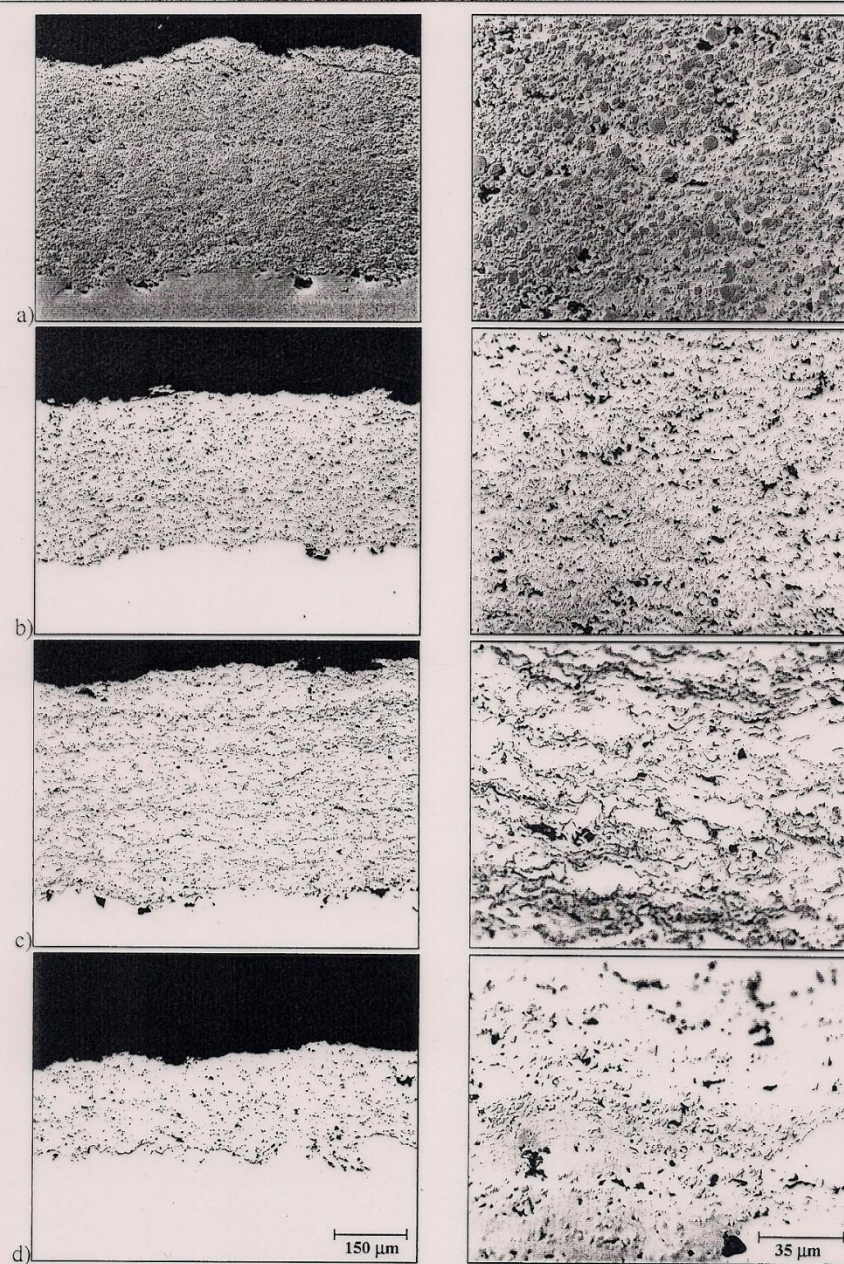


Figura 4.3 – Imagens do MO mostrando camadas, 200x e 1000x - pistola DJ 2700

a) M1, WC-17Co, -53+11 μm , aspergido sinterizado

b) M2, WC-10Co-4Cr, -53+11 μm , aglomerado sinterizado

c) M3, Cr_3C_2 -25(Ni 20Cr), -45+5.5 μm , misturado

d) M4, (WC-12Co) 33Ni 9Cr 3,5Fe 2Si 2B 0,5C, -45+11 μm , misturado



Figura 4.7 – Imagens do MO mostrando camadas, 200x e 1000x - pistola JP 5000

a) T1, WC-17Co, -45+15 μm , aspergido sinterizado

b) T2, WC-10Co-4Cr, -45+15 μm , aspergido sinterizado

c) T3, Cr_3C_2 -25(Ni 20Cr), -45+15 μm , aspergido sinterizado

d) T4, Ni 17.3W 15Cr 4Si 3.5Fe 3B 0.8C, -53+20 μm , atomizado

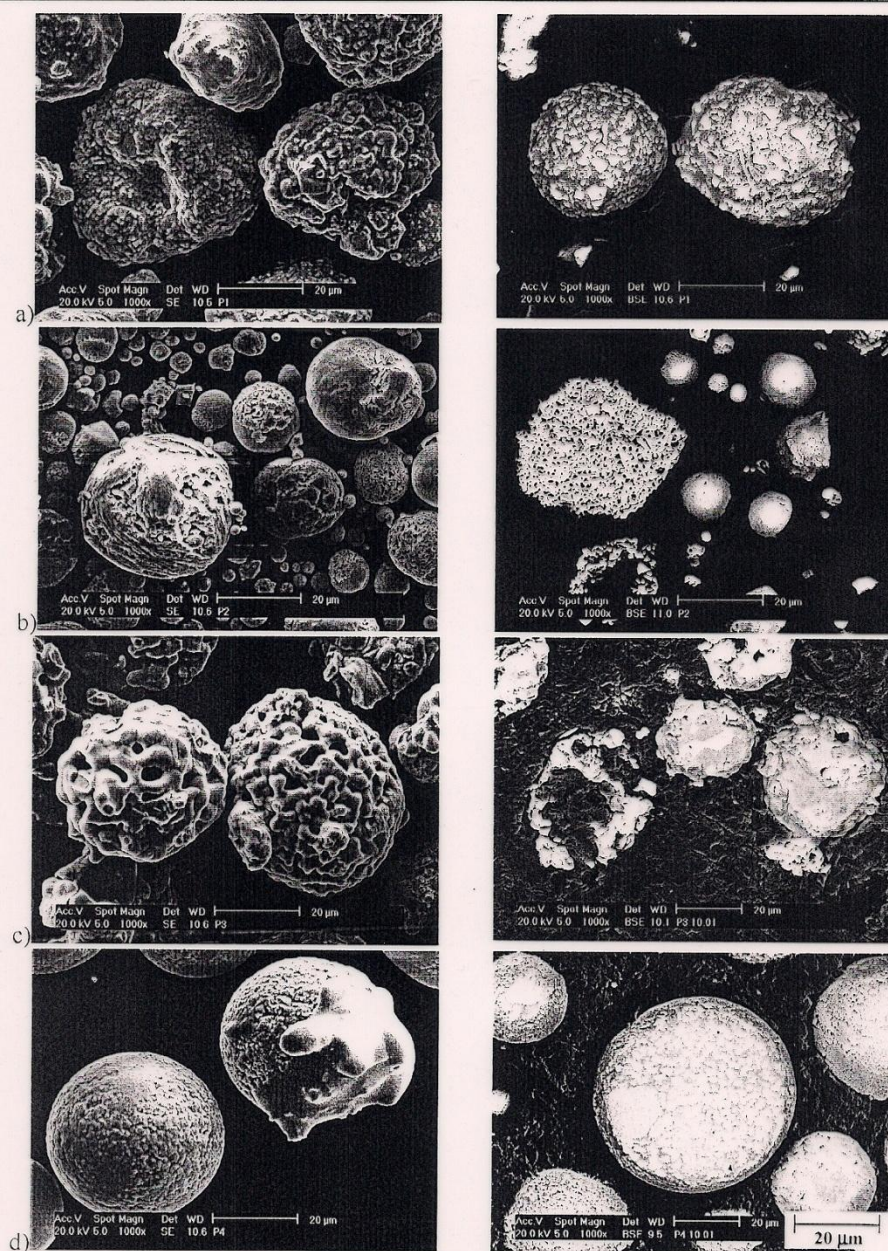


Figura 4.8 – Morfologia e a microestrutura dos pós aspergidos pela pistola JP 5000; 1000x

- a) T1, WC-17Co, -45+15 µm, aspergido sinterizado
- b) T2, WC-10Co-4Cr, -45+15 µm, aspergido sinterizado
- c) T3, Cr₃C₂-25(Ni 20Cr), -45+15 µm, aspergido sinterizado
- d) T4, Ni 17.3W 15Cr 4Si 3.5Fe 3B 0.8C, -53+20 µm, atomizado

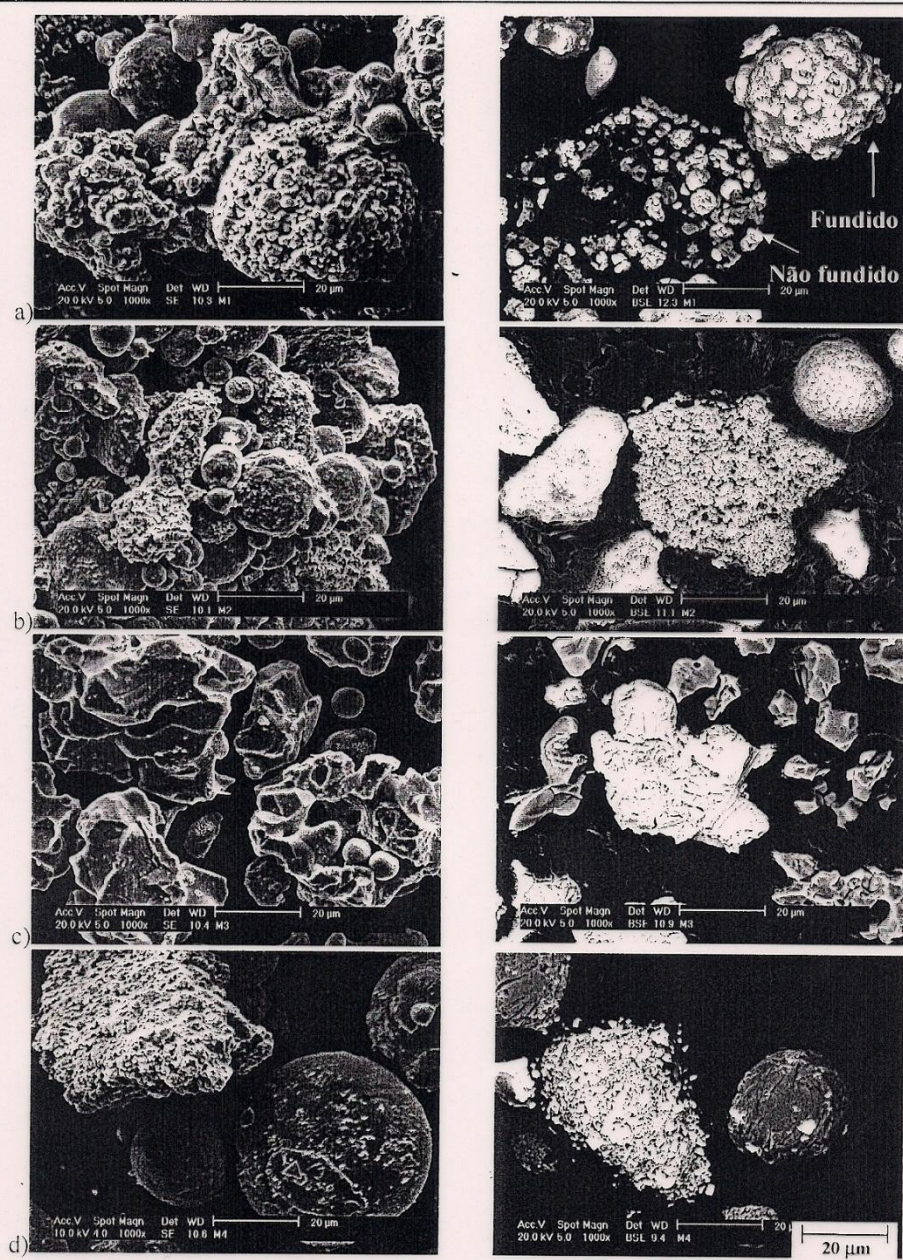


Figura 4.4 – Morfologia e a microestrutura dos pós aspergidos pela pistola DJ 2700; 1000x

- a) M1, WC-17Co, -53+11 µm, aspergido sinterizado
- b) M2, WC-10Co-4Cr, -53+11 µm, aglomerado sinterizado
- c) M3, Cr₃C₂-25(Ni 20Cr), -45+5.5 µm, misturado
- d) M4, (WC-12Co) 33Ni 9Cr 3,5Fe 2Si 2B 0,5C, -45+11 µm, misturado

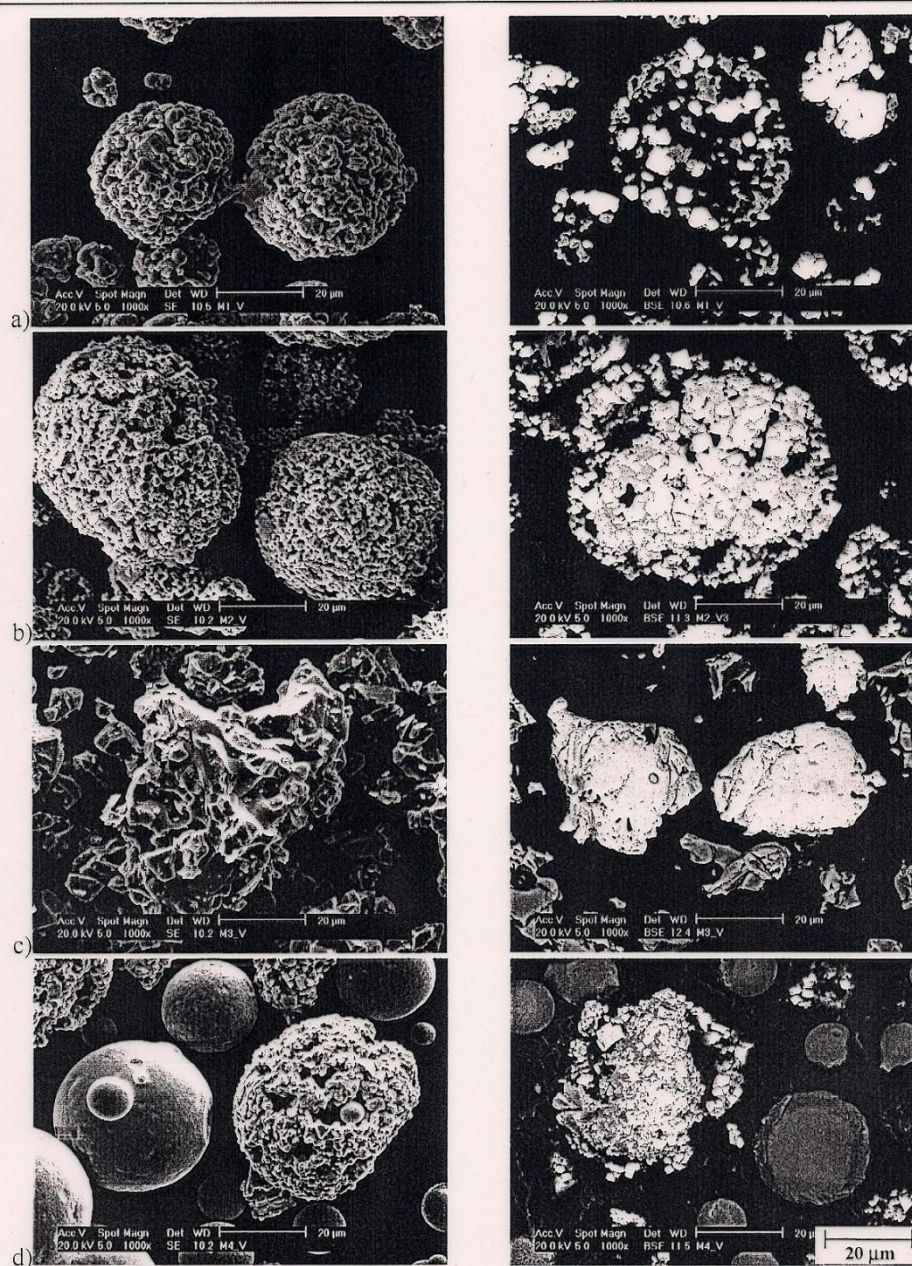


Figura 4.2 – Morfologia e a microestrutura dos pós empregados na pistola DJ 2700; 1000x

- a) M1, WC-17Co, -53+11 µm, aspergido sinterizado
- b) M2, WC-10Co-4Cr, -53+11 µm, aglomerado sinterizado
- c) M3, Cr₃C₂-25(Ni 20Cr), -45+5.5 µm, misturado
- d) M4, (WC-12Co) 33Ni 9Cr 3,5Fe 2Si 2B 0,5C, -45+11 µm, misturado

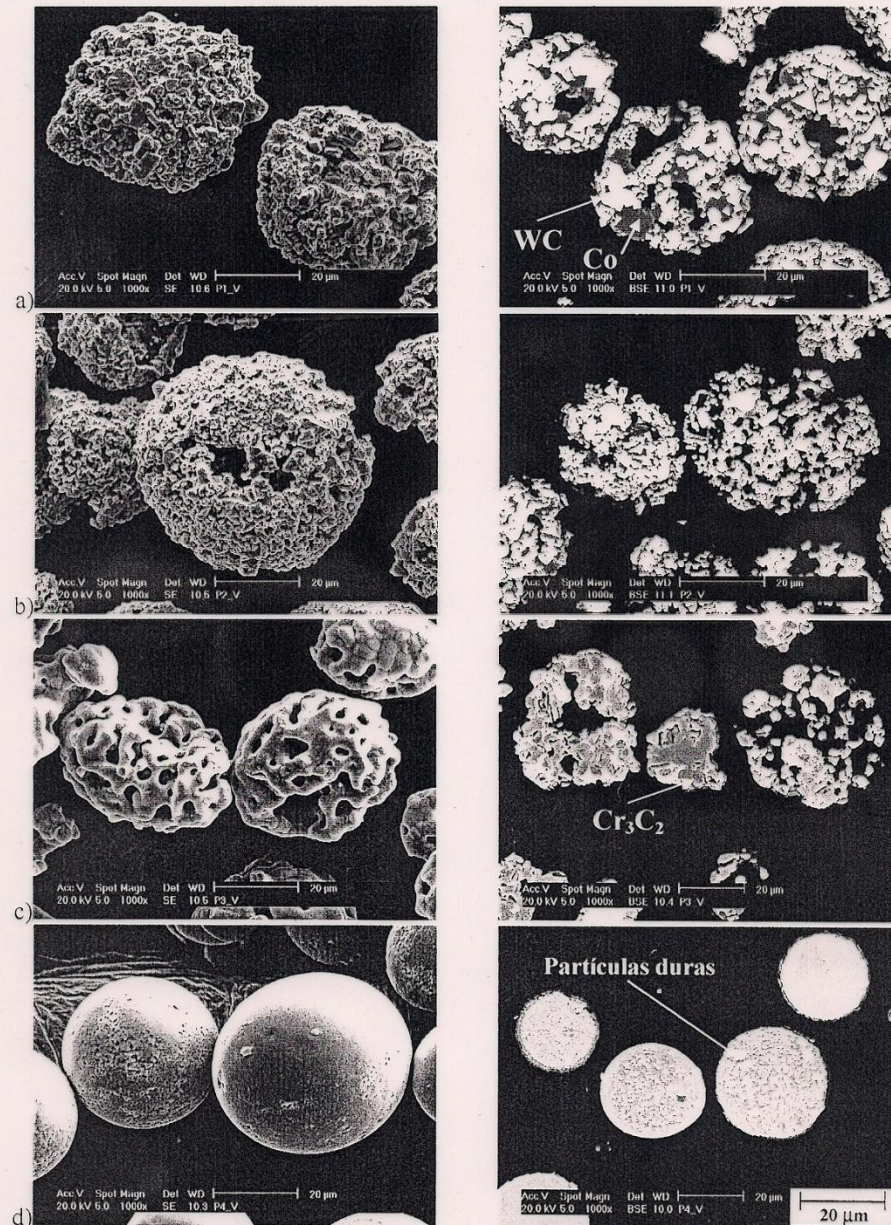


Figura 4.1 – Morfologia e a microestrutura dos pós empregados na pistola JP 5000; 1000x

- a) T1, WC-17Co, -45+15 µm, aspergido sinterizado
- b) T2, WC-10Co-4Cr, -45+15 µm, aspergido sinterizado
- c) T3, Cr₃C₂-25(Ni 20Cr), -45+15 µm, aspergido sinterizado
- d) T4, Ni 17.3W 15Cr 4Si 3.5Fe 3B 0.8C, -53+20 µm, atomizado

SELAGEM

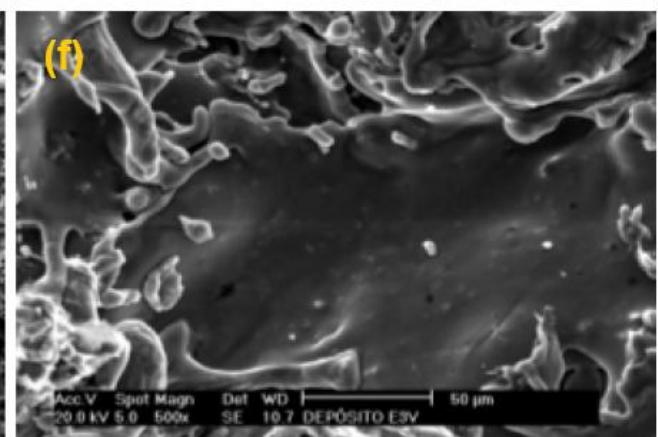
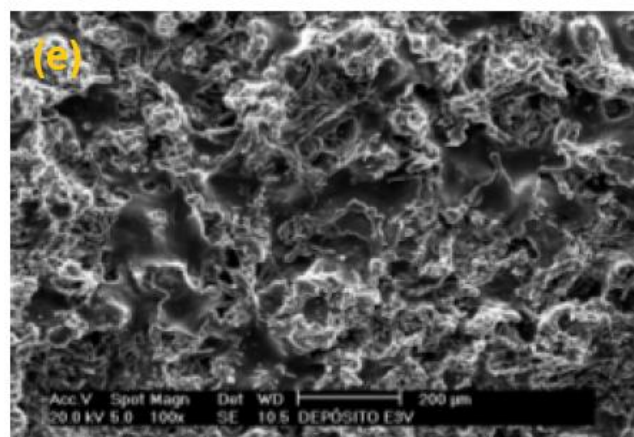
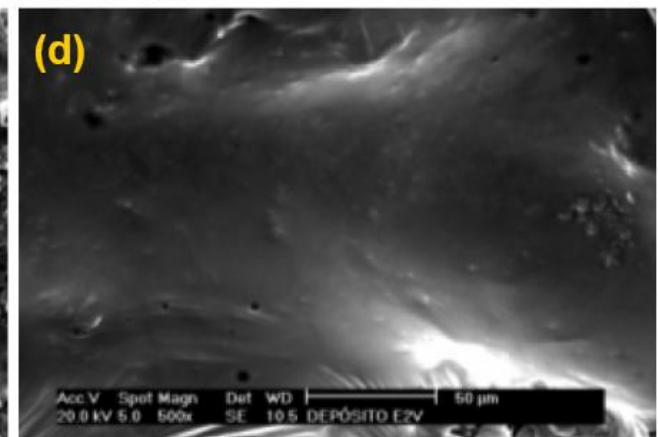
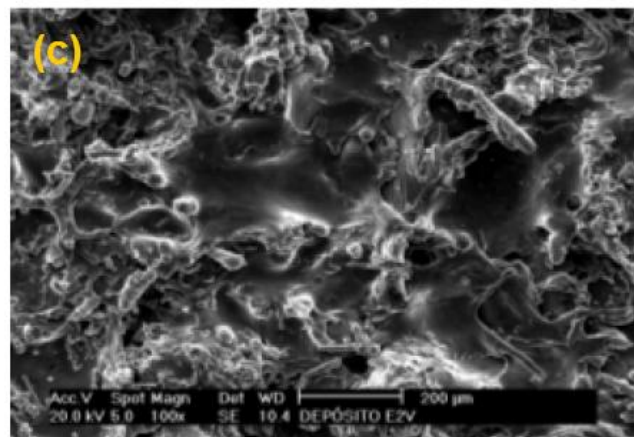
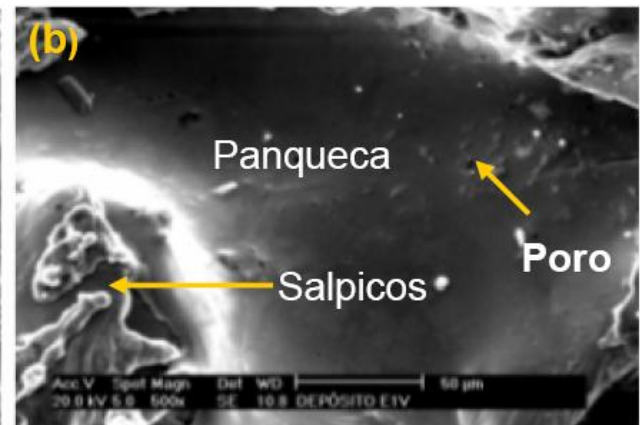
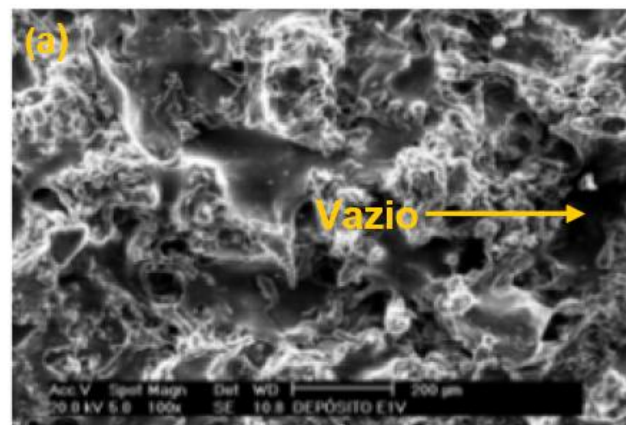
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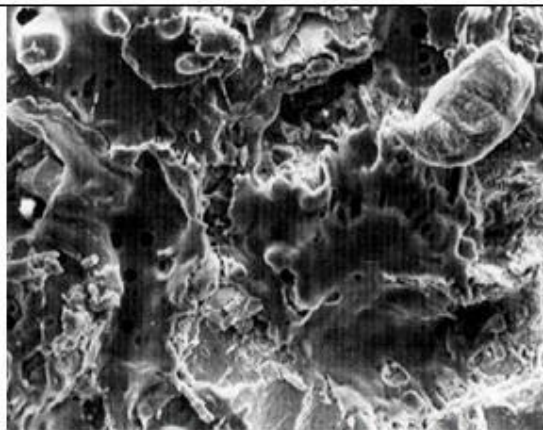
- Penetração no revestimento a quente
- Resistência a solventes
- Resistência a ações mecânicas
- Estabilidade térmica
- Não alterar o revestimento
- Não tóxico
- Facilidade de aplicação

Tipos:

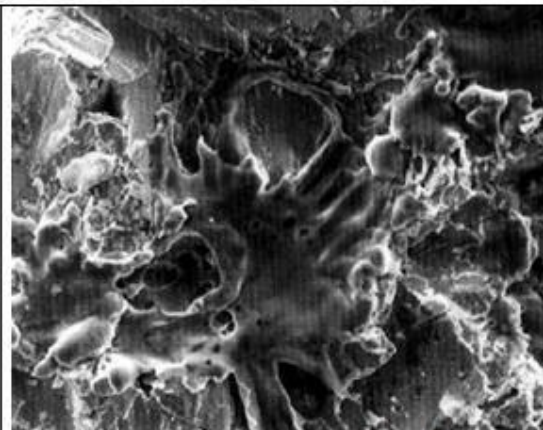
- Resinas de vinil
- Resinas fenólicas
- Epóxi fenolicas e poliuretanas
- Cera
- Tintas acrílicas
- Tintas diluídas em geral
- Ligas Poliméricas

Superfícies de
revestimentos de
alumínio depositados
pelo processo ASP

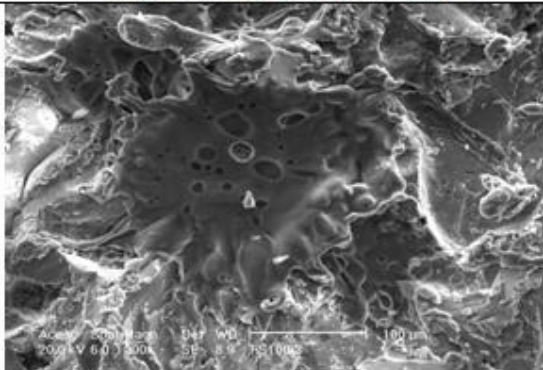




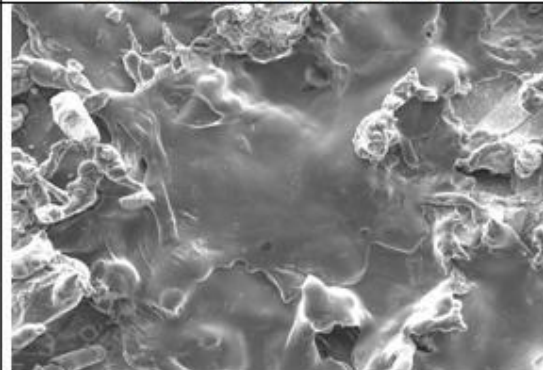
(a) rugosidade do substrato Ry 70/80 μm
sem pré-aquecimento / processo FS



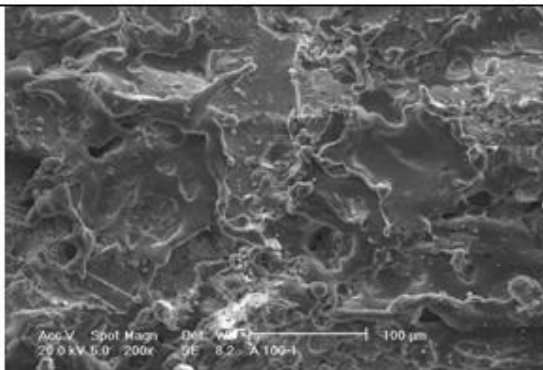
(b) rugosidade do substrato Ry 70/80 μm
com pré-aquecimento / processo FS



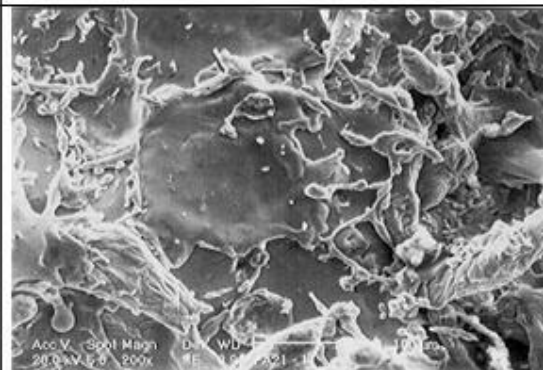
(c) rugosidade do substrato Ry 50/60 μm
sem pré-aquecimento / processo FS



(d) rugosidade do substrato Ry 50/60 μm
com pré-aquecimento / processo FS



(e) rugosidade do substrato Ry 50/60 μm
sem pré-aquecimento / processo ASP



(f) rugosidade do substrato Ry 50/60 μm
com pré-aquecimento / processo ASP

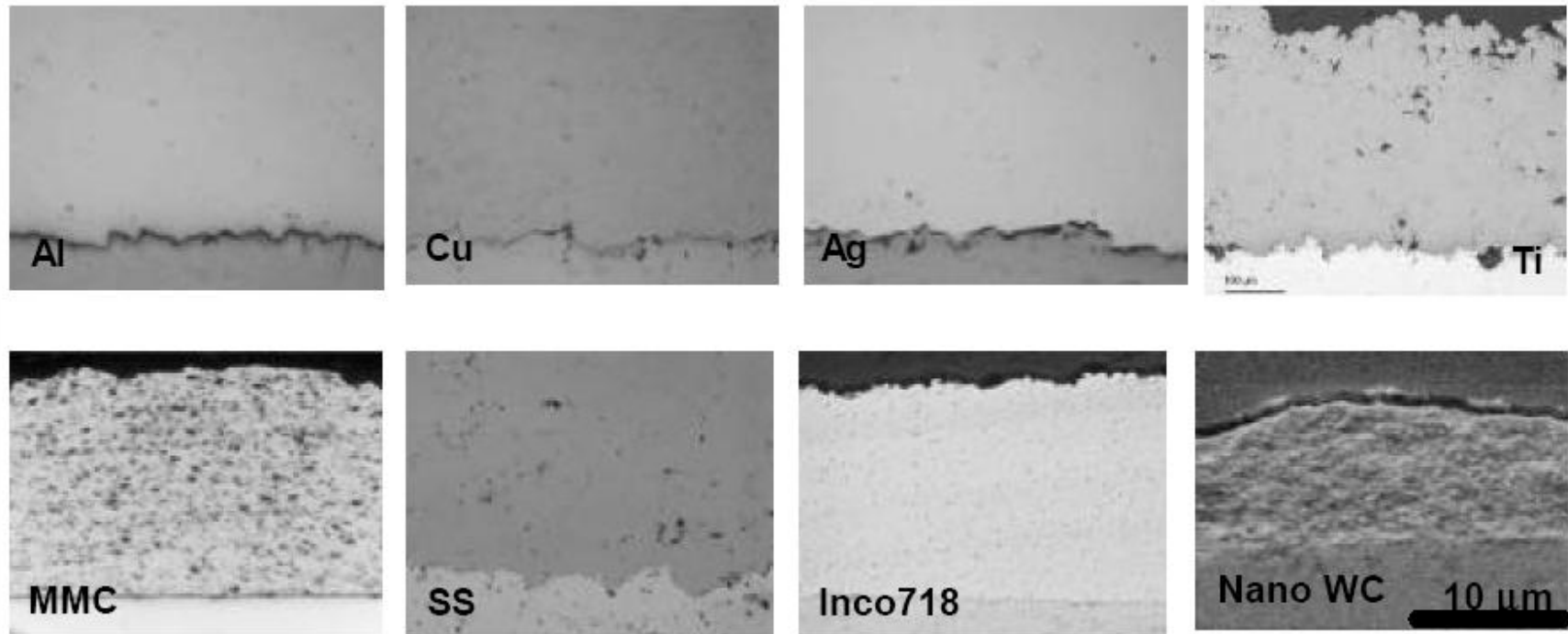


Figure 4: Microstructures of Cold Sprayed Coatings