

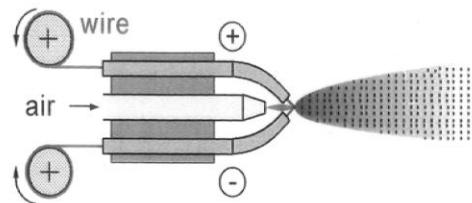
MICROESTRUTURAS DE REVESTIMENTOS DEPOSITADOS PELOS PROCESSOS DE ASPERSÃO TÉRMICA

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

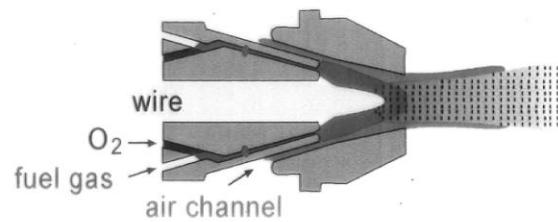


Thermal Spray Processes

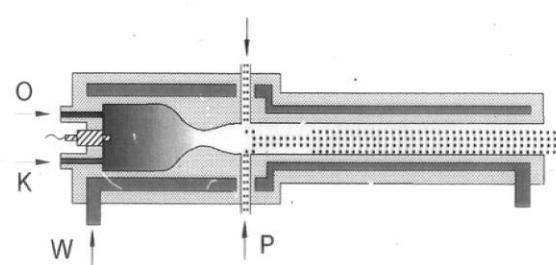
wire arc spraying



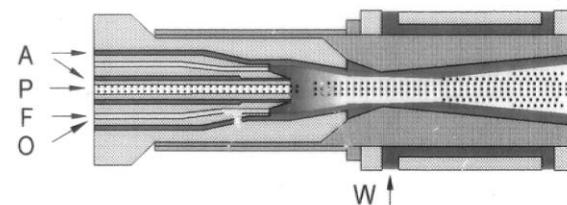
flame spraying (wire)



HVOF : JP-5000

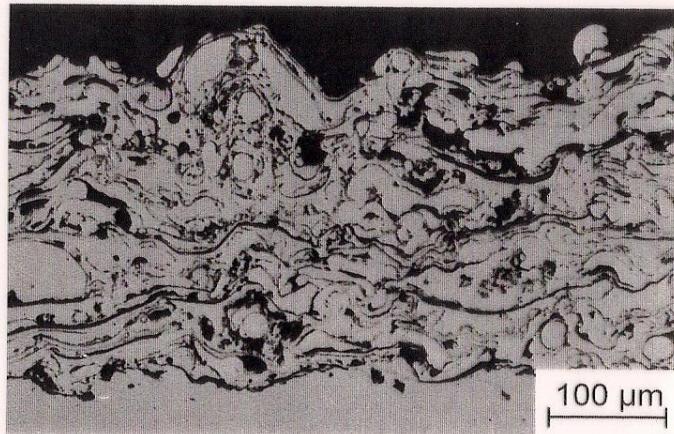


HVOF : DJ 2600, DJ 2700

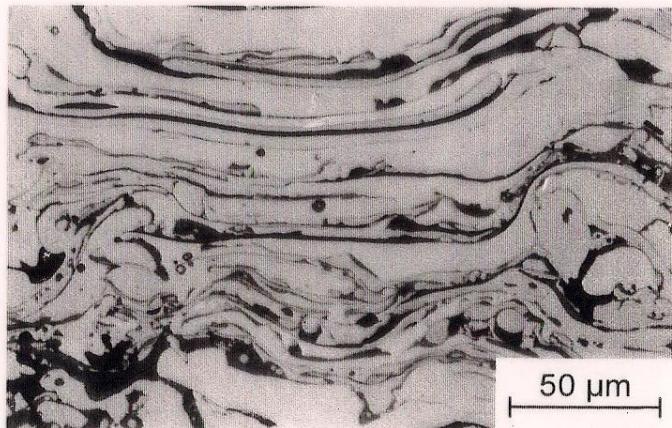
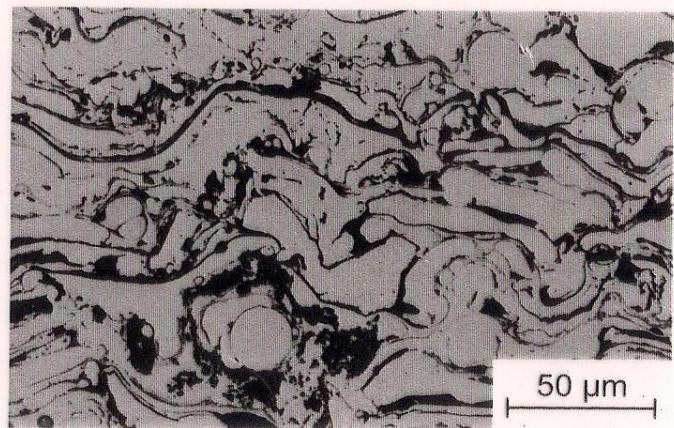
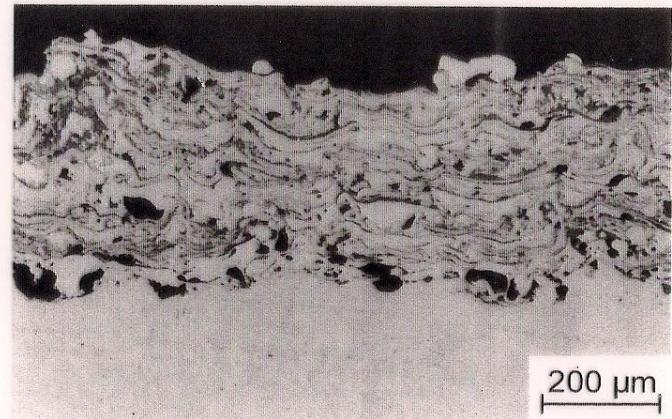


Microstructure of Thermal Spray Coatings (13 Cr-Steel)

arc sprayed

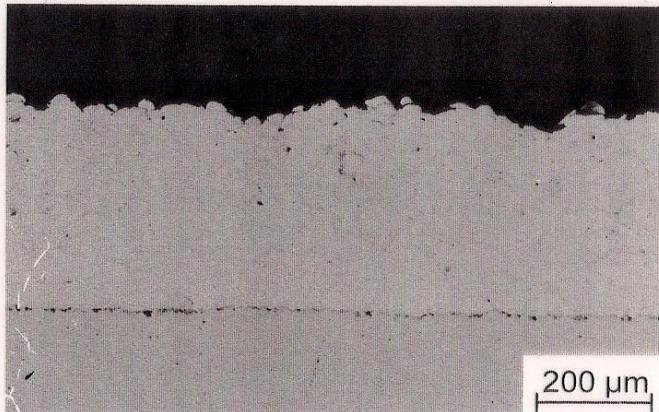


flame sprayed

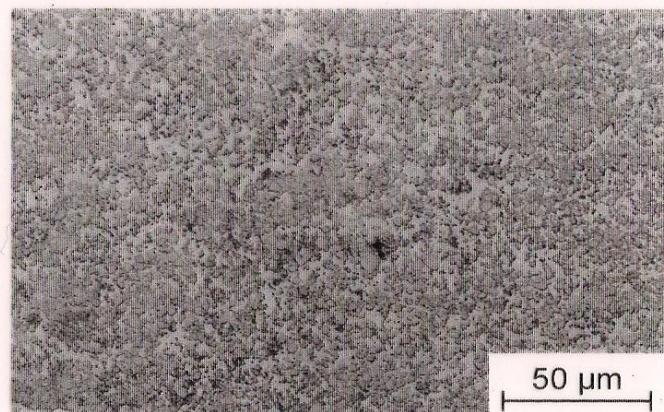
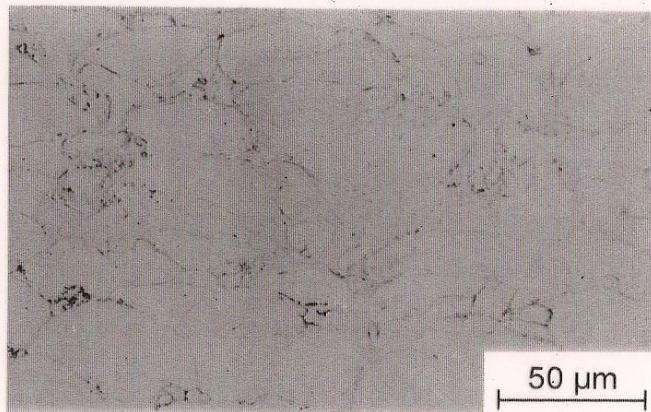
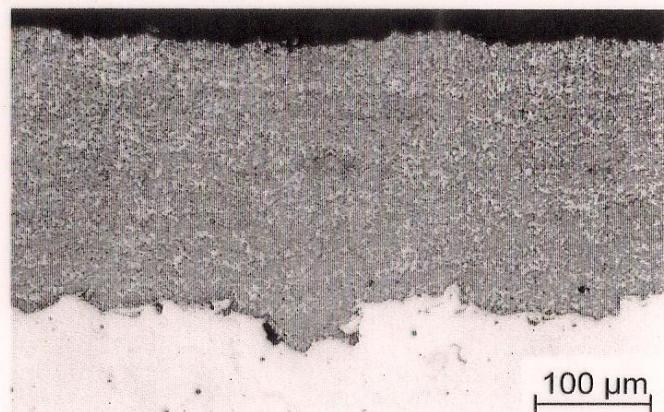


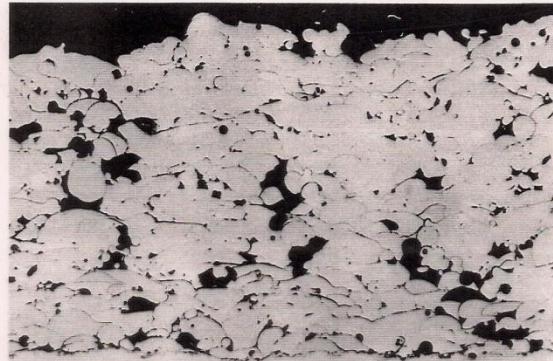
Microstructure of Thermal Spray Coatings (HVOF)

stainless steel 316 L JP-5000 / kerosene



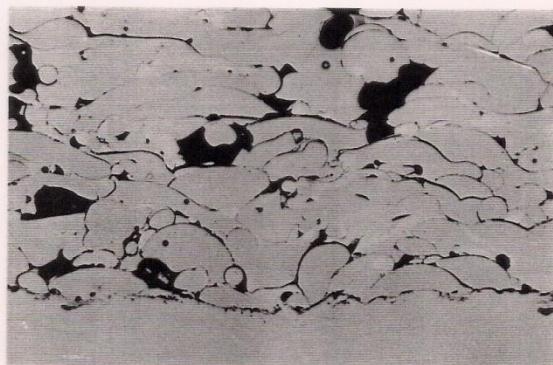
WC-Co 83-17 DJ 2700 / ethylene





1190/18

100x



1190/19

200x



1190/20

500x

ild 5a: Gefüge der NiCrBSi-Schicht (T5.2 ;
konventionelles Flammspritzen) /FS po

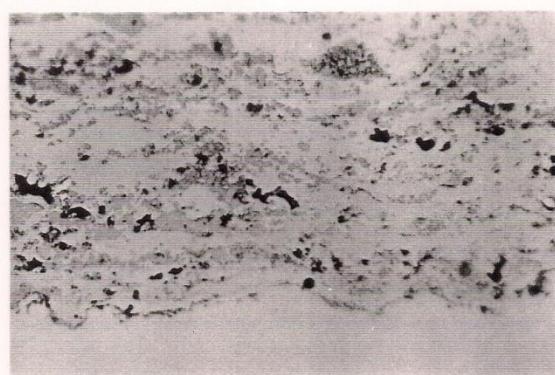
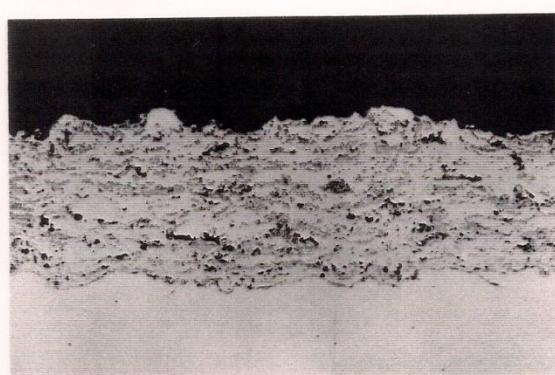
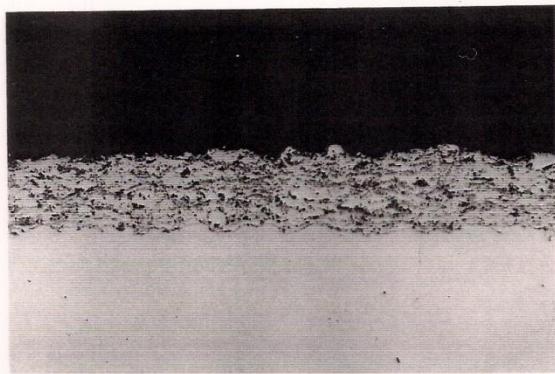
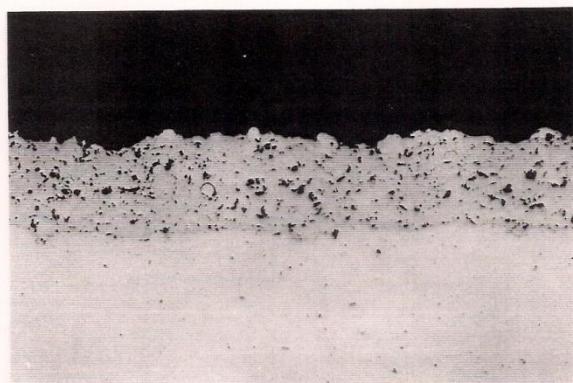
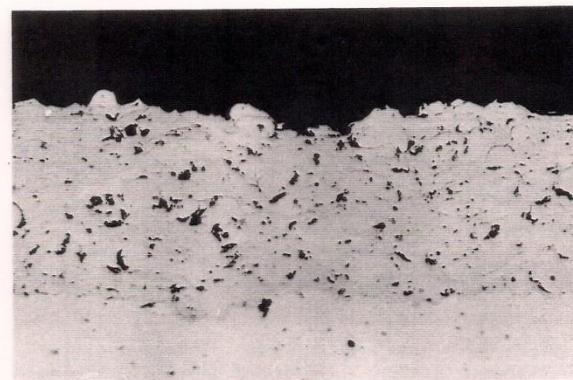


Bild 3a: Gefüge der NiCrBSi - Schicht mit 50% WC-Co
(T 3.2, HVOF)



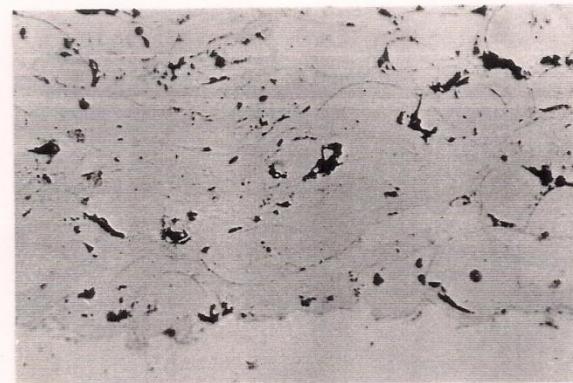
1190 / 11

100x



1190 / 12

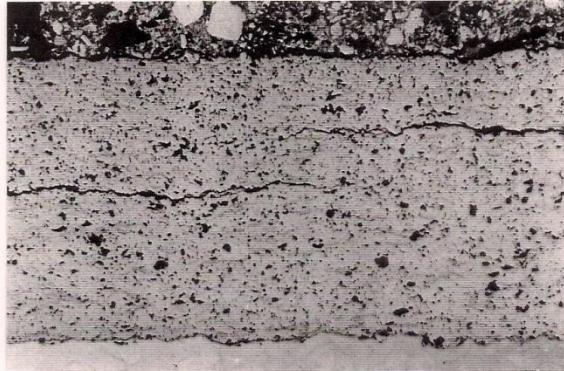
200x



1190 / 13

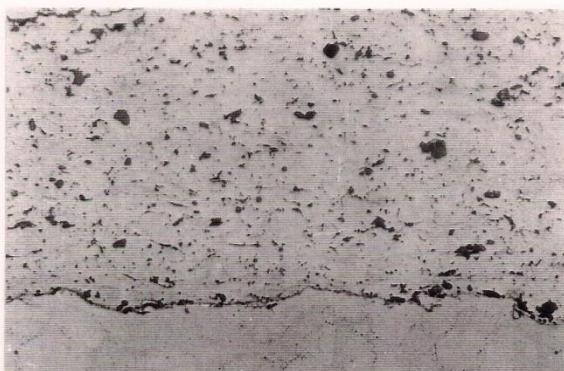
500x

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)

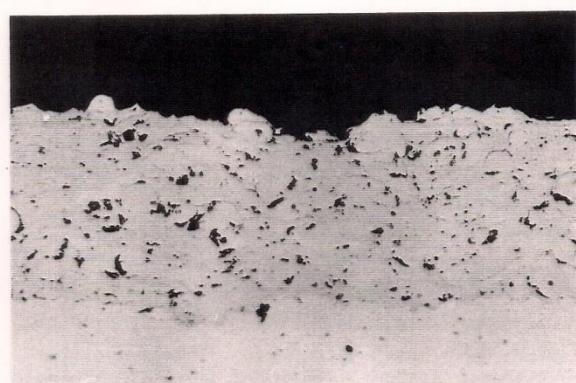
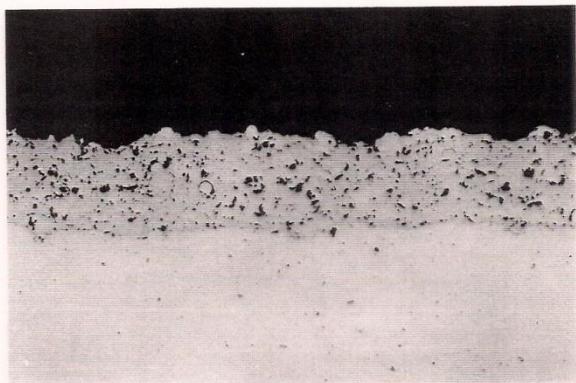


Bild 2a: Gefüge der NiCrBSi-Schicht (T21, HVOF)

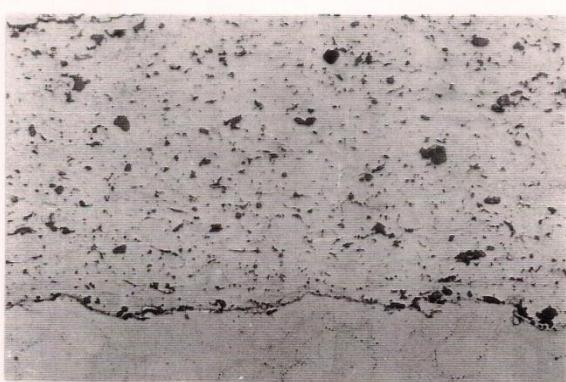
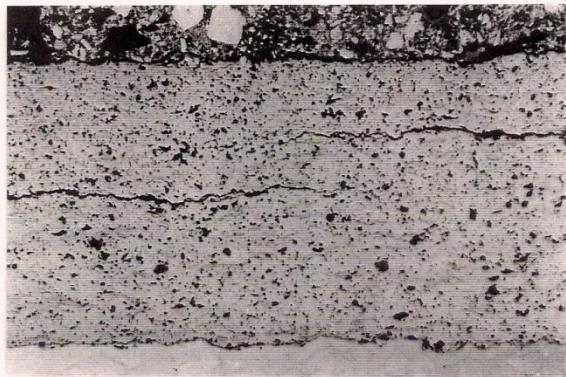


Bild 4a : Gefüge der Al_2O_3 -Schicht , kontrastiert
(T4.1, Plasmaspritzen)

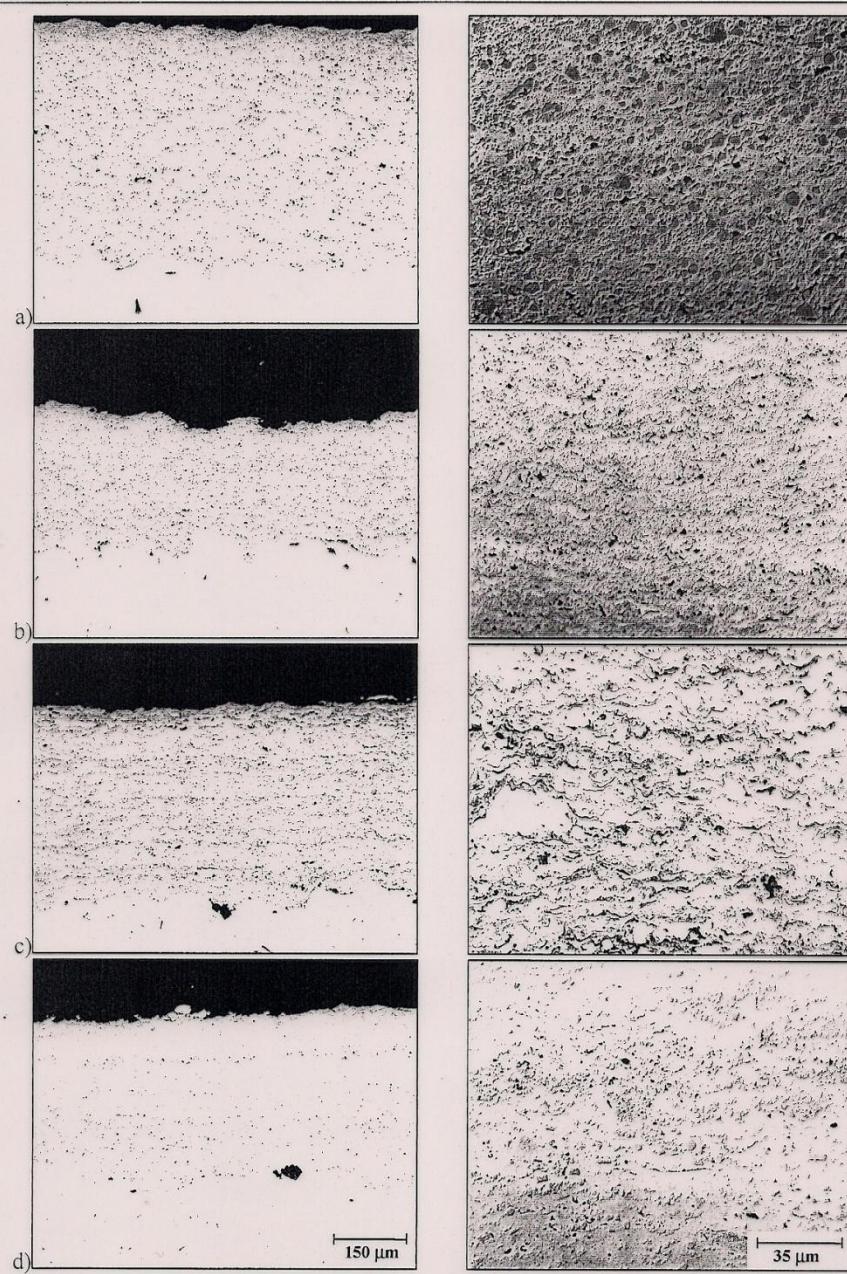


Figura 4.5 – Imagens do MO mostrando camadas, 200x e 1000x - pistola DJ 2700

- a) M1, WC-17Co, -53+11 μm , aspergido sinterizado
- b) M2, WC-10Co-4Cr, -53+11 μm , aglomerado sinterizado
- c) M3, 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

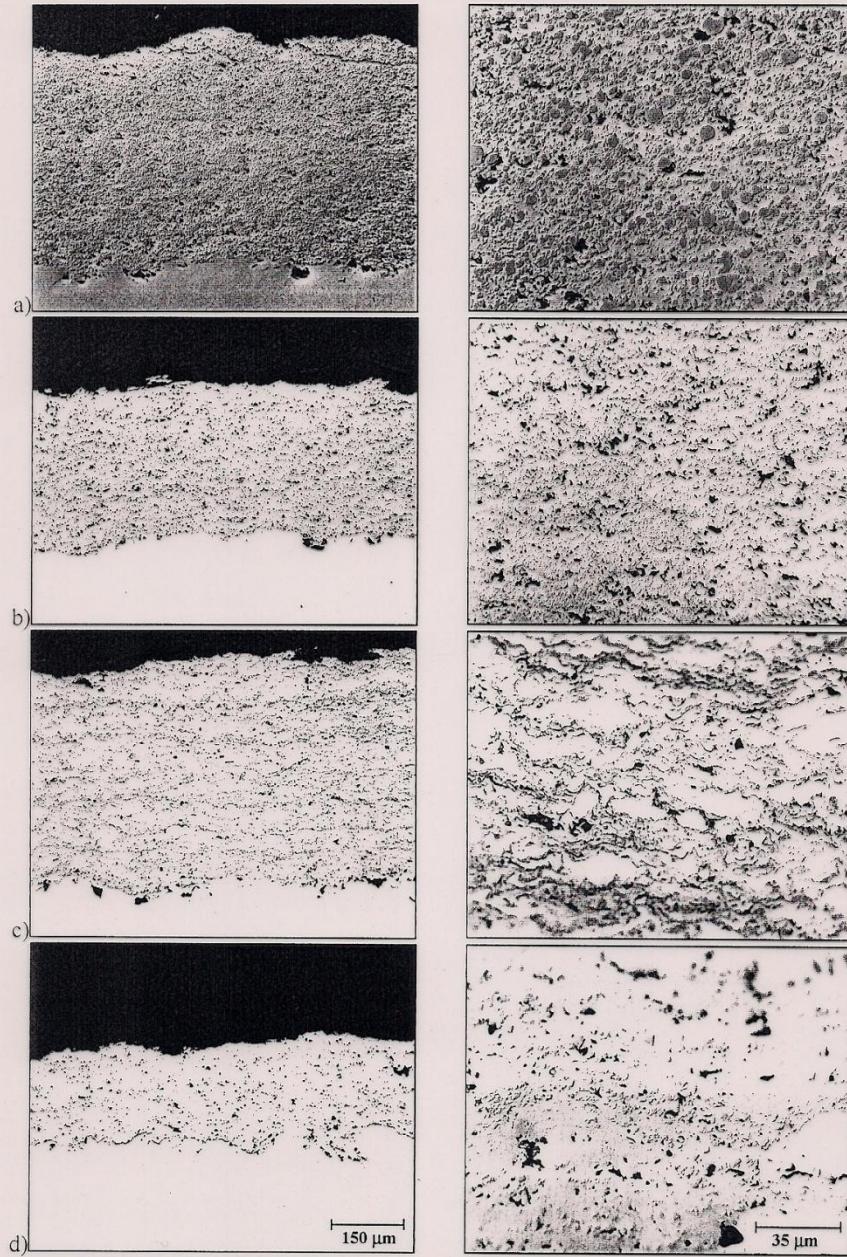


Figura 4.3 – Imagens do MO mostrando camadas, 200x e 1000x - pistola DJ 2700

- a) M1, WC-17Co, -53+11 μm, aspergido sinterizado
- b) M2, WC-10Co-4Cr, -53+11 μm, aglomerado sinterizado
- c) M3, 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 4.7 – 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, 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

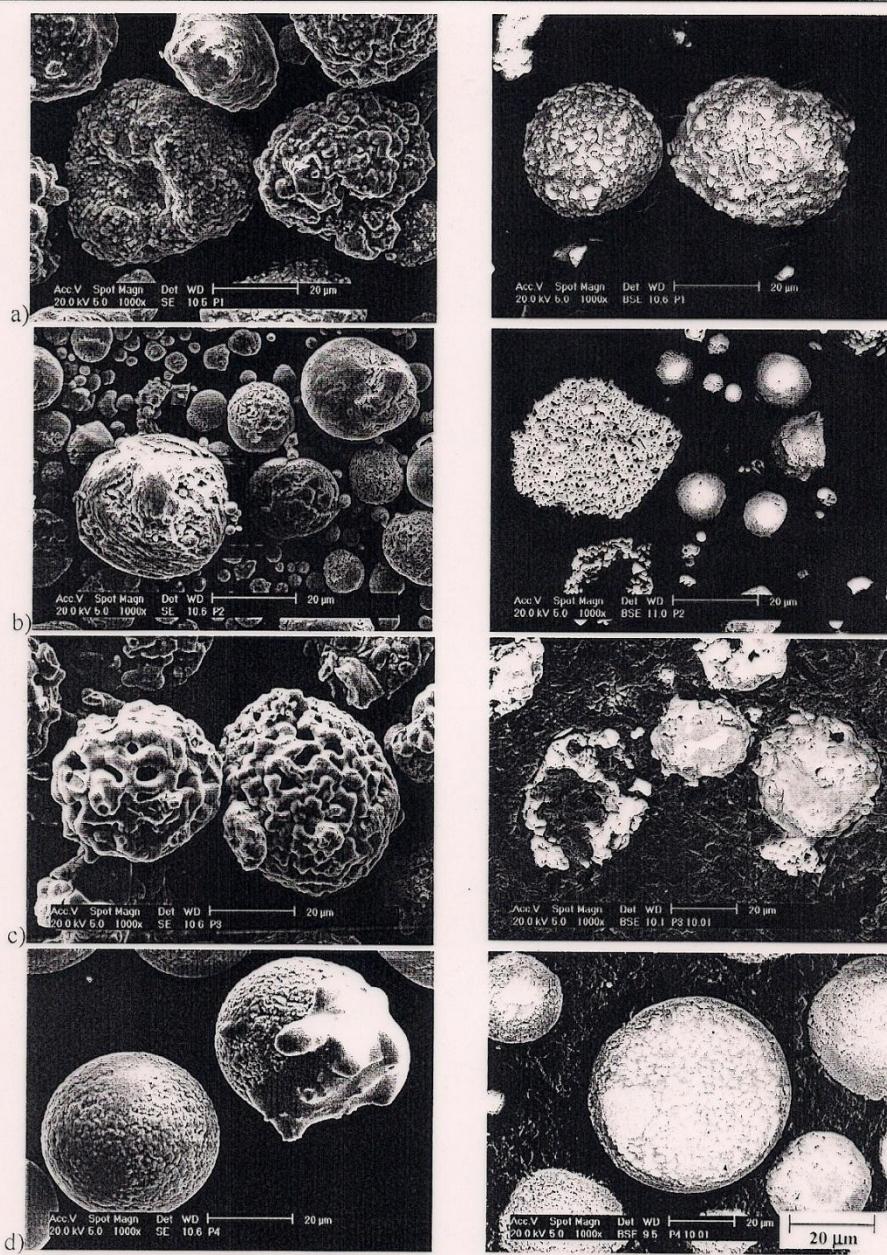


Figura 4.8 – Morfologia e a microestrutura dos pós aspergidos pela pistola JP 5000; 1000x

- 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

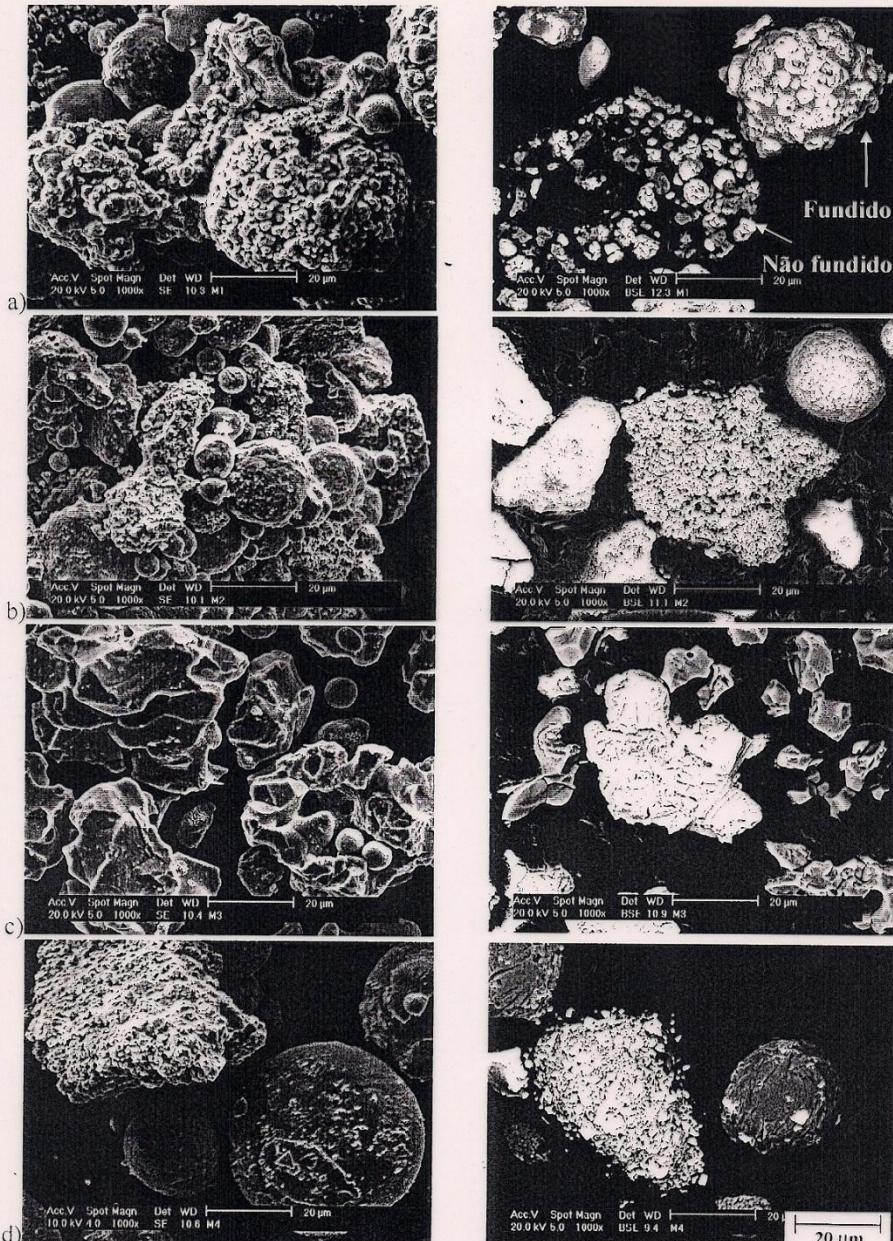


Figura 4.4 – Morfologia e a microestrutura dos pós aspergidos pela pistola DJ 2700; 1000x

- 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

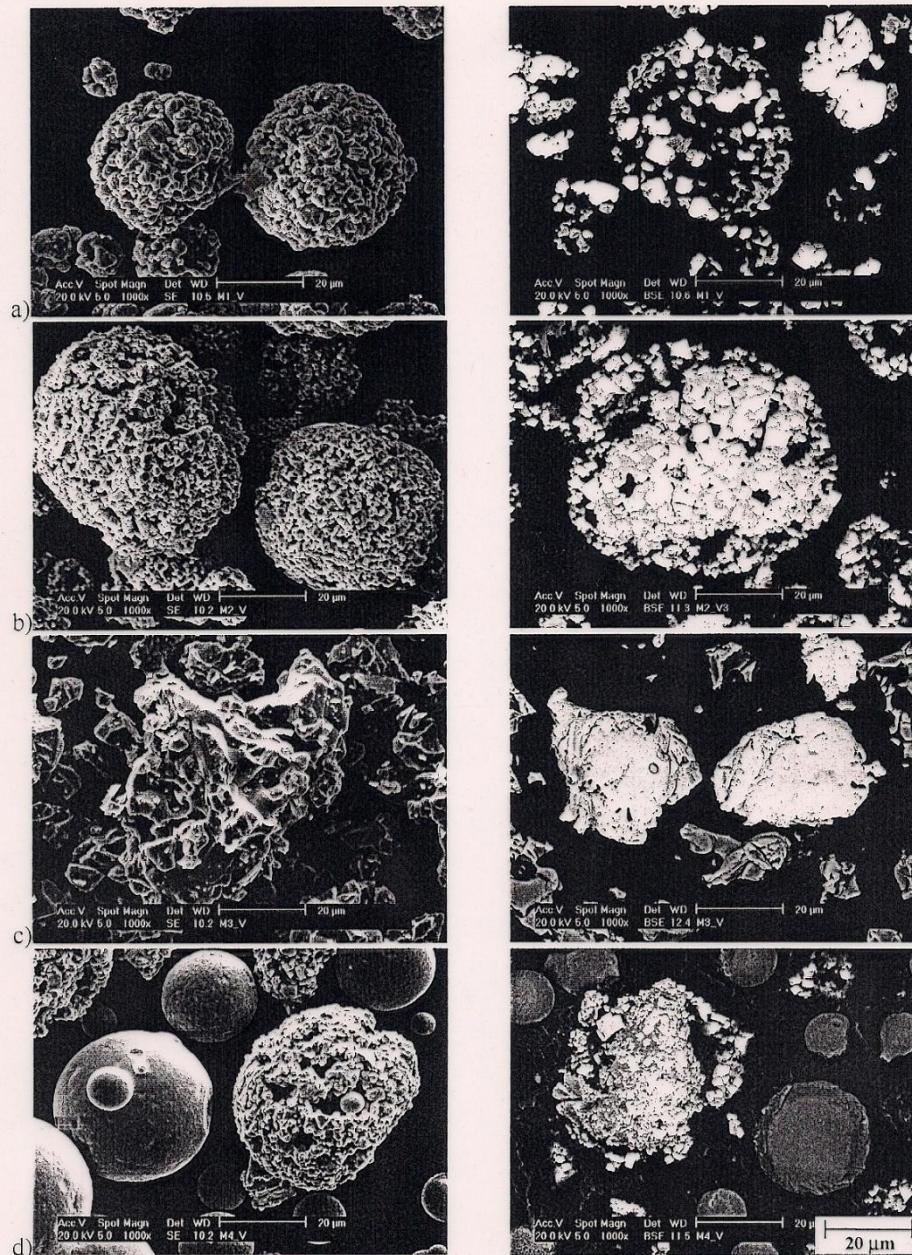


Figura 4.2 – Morfologia e a microestrutura dos pós empregados na pistola DJ 2700; 1000x

- 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

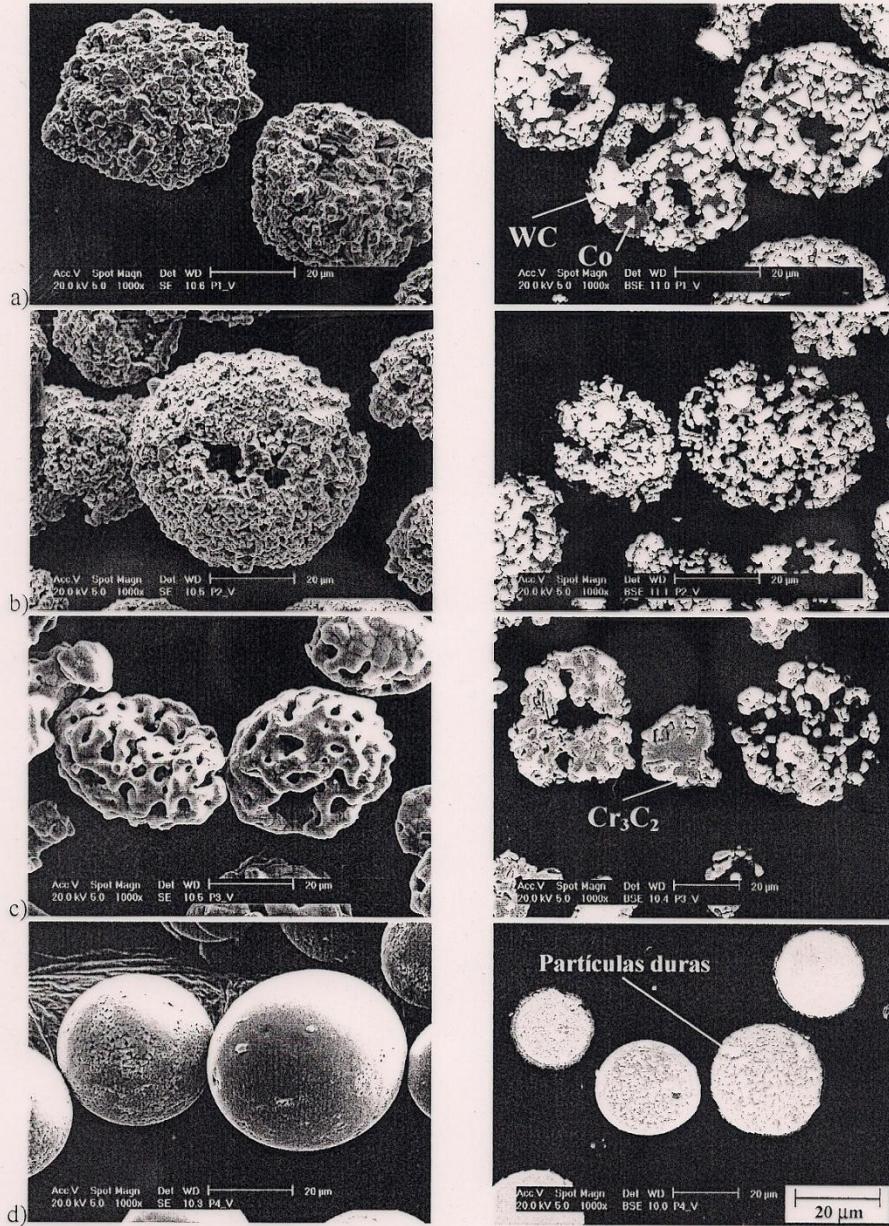


Figura 4.1 – Morfologia e a microestrutura dos pós empregados na pistola JP 5000; 1000x

- 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

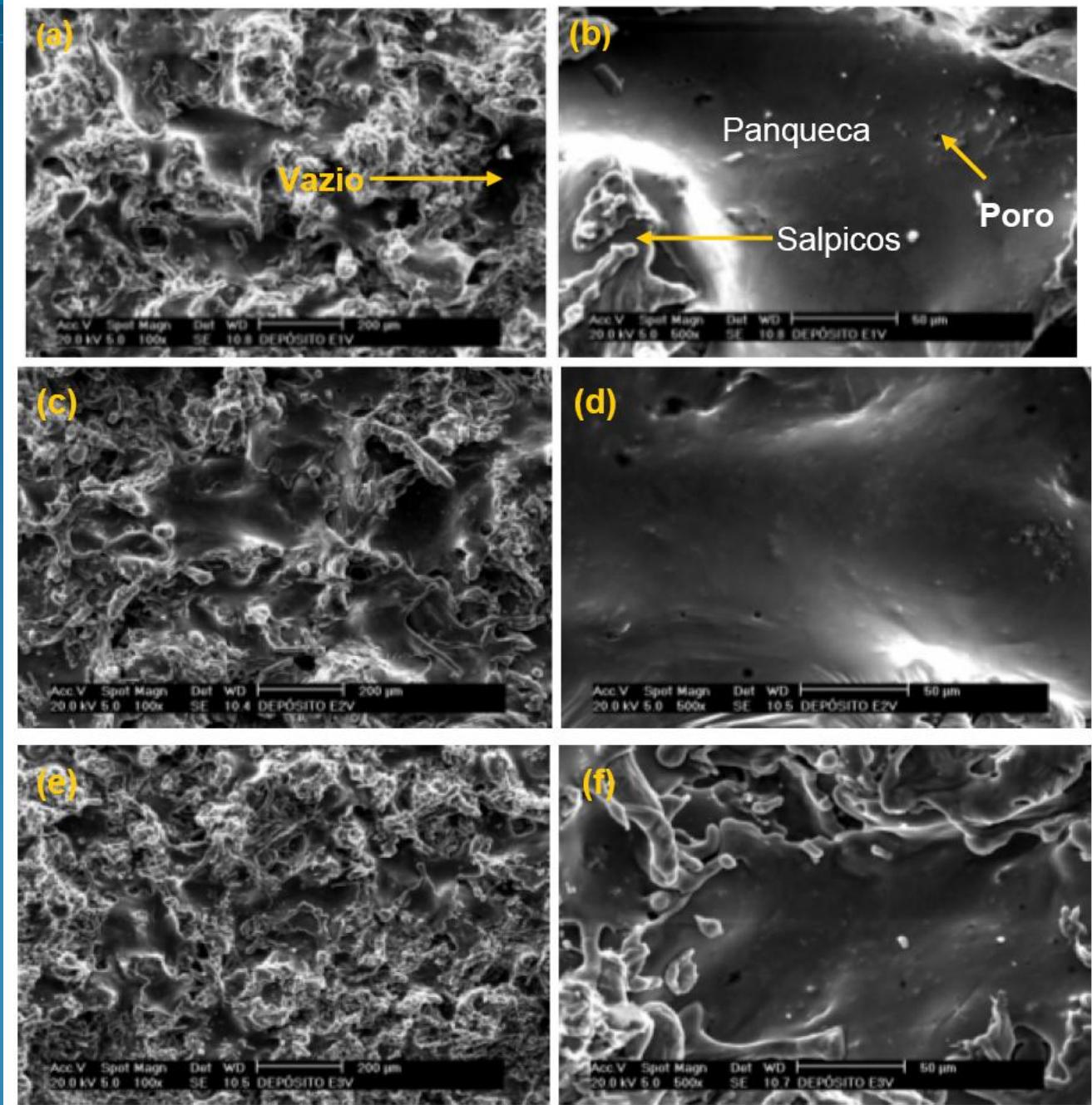
Características:

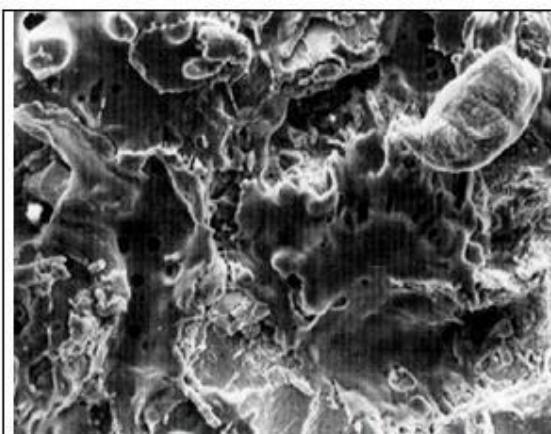
- Penetração no revestimento a quente
- Resistência a solventes
- Resistência a ações mecânicas
- Estabilidade térmica
- Não alterar o revestimento
- Não tóxico
- Facilidade de aplicação

Tipos:

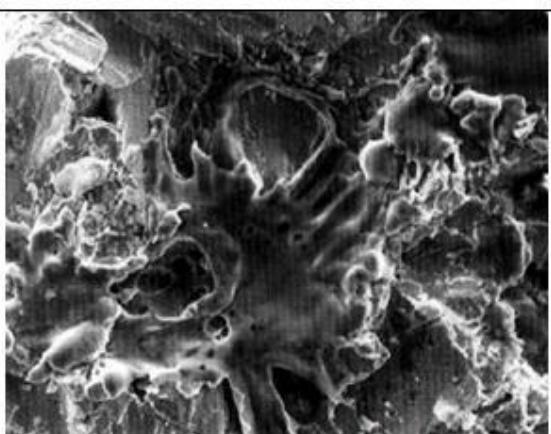
- Resinas de vinil
- Resinas fenólicas
- Epóxi fenólicas e poliuretanas
- Cera
- Tintas acrílicas
- Tintas diluídas em geral
- Ligas Poliméricas

Superfícies de revestimentos de alumínio depositados pelo processo ASP

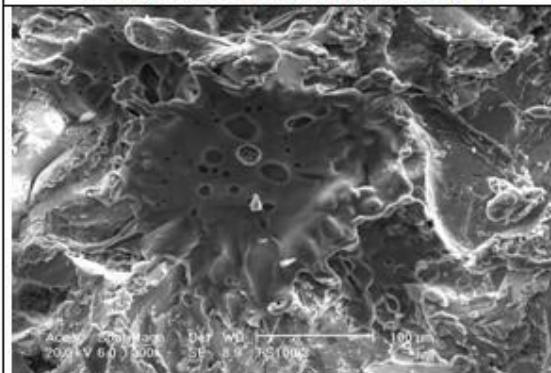




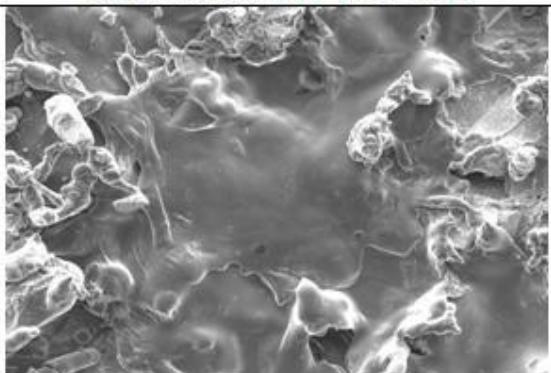
(a) rugosidade do substrato Ry 70/80 µm
sem pré-aquecimento / processo FS



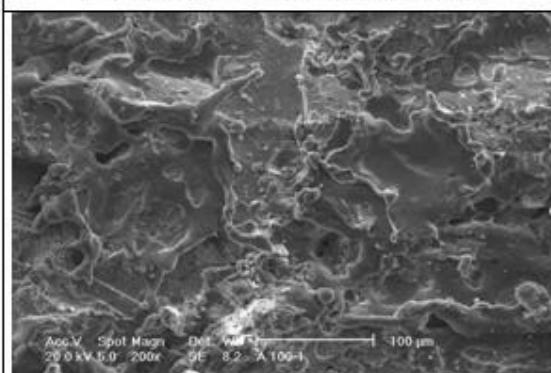
(b) rugosidade do substrato Ry 70/80 µm
com pré-aquecimento / processo FS



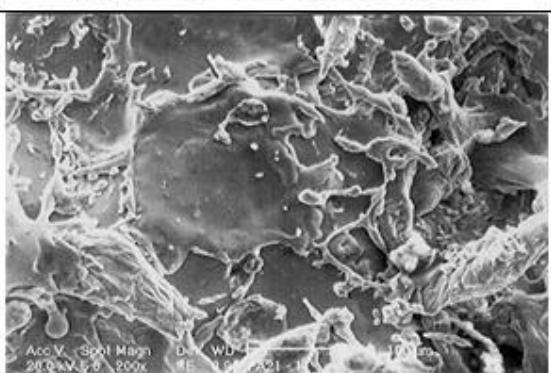
(c) rugosidade do substrato Ry 50/60 µm
sem pré-aquecimento / processo FS



(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

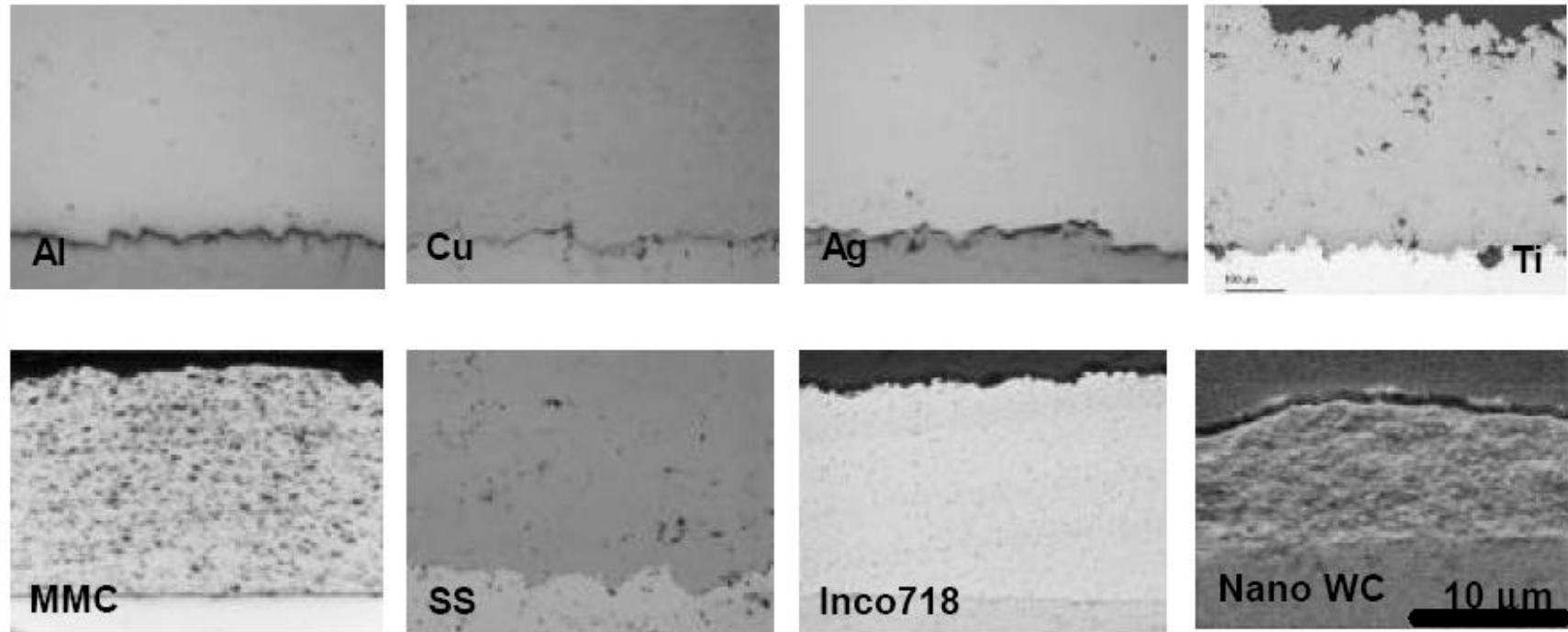


Figure 4: Microstructures of Cold Sprayed Coatings