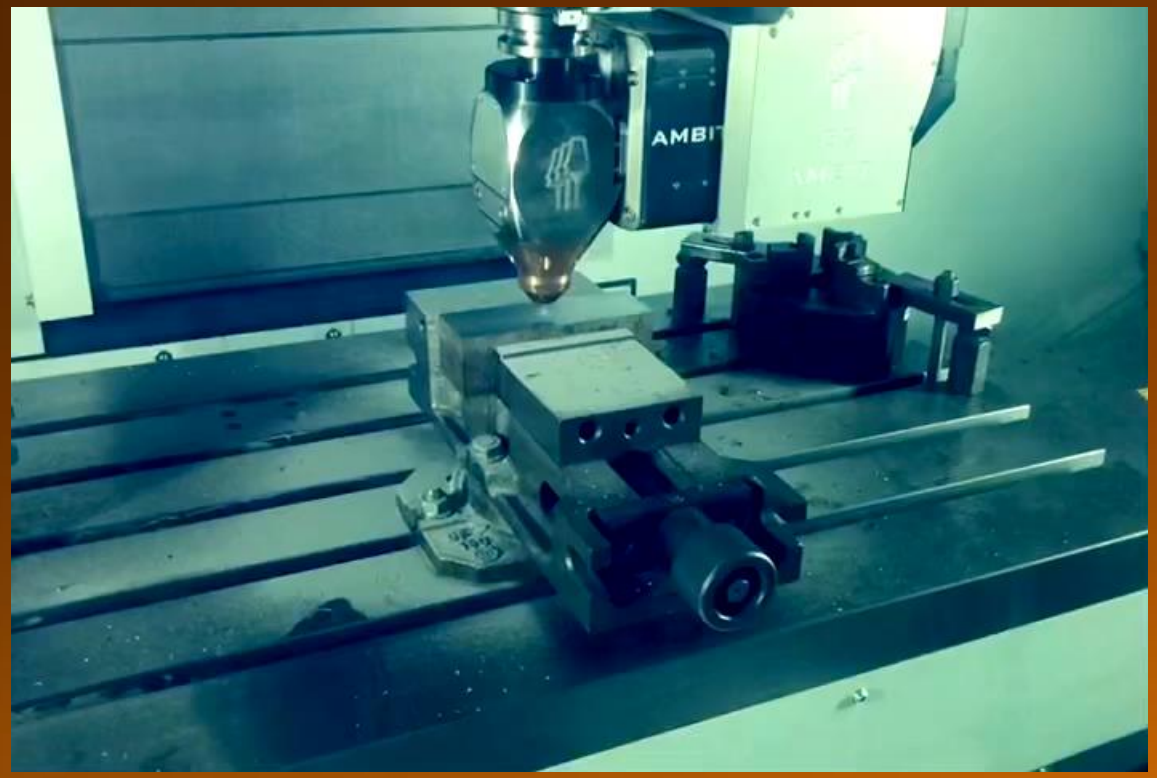
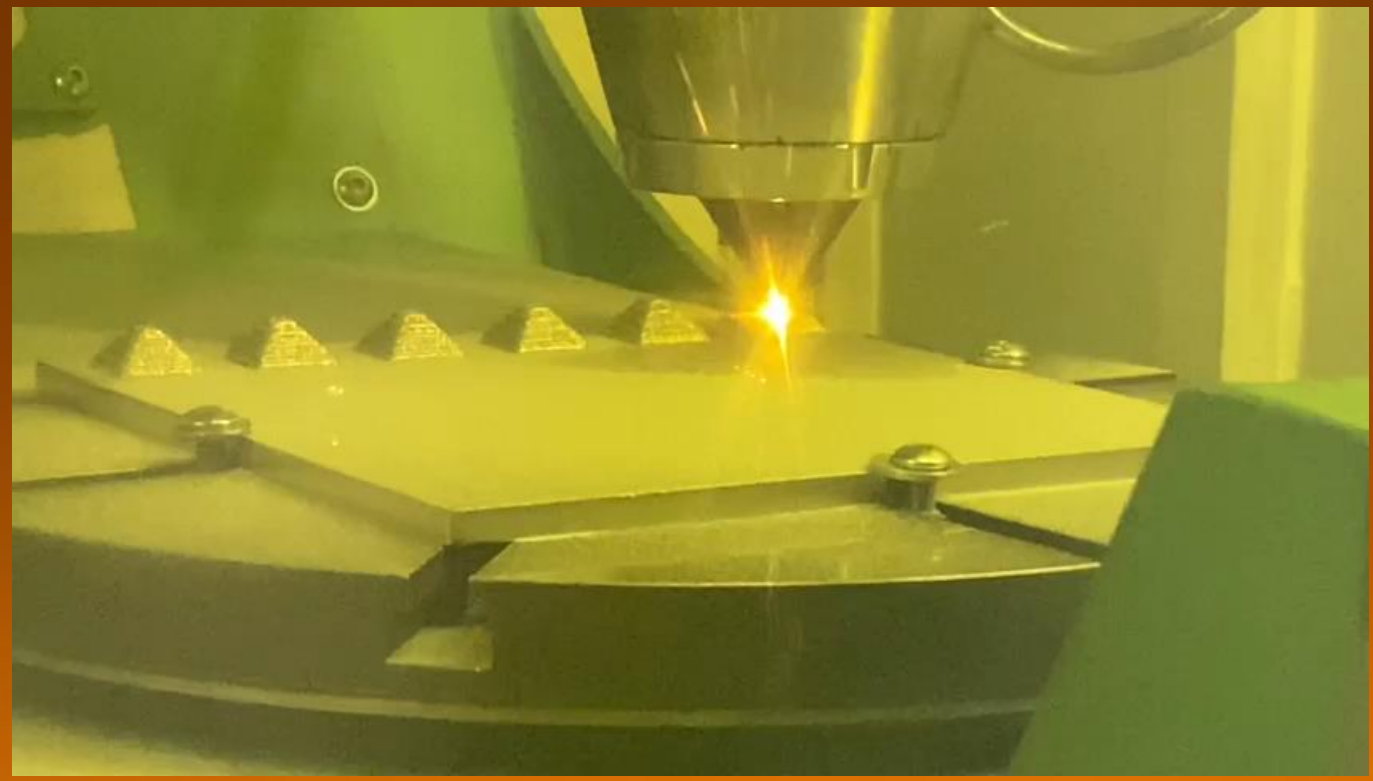
DIRECTED ENERGY DEPOSITION





rtcoelho@sc.usp.br

PROCESSOS DE MANUFATURA ADITIVA

DIRECTED ENERGY DEPOSITION – Metal Powder

Métodos de produção de pó

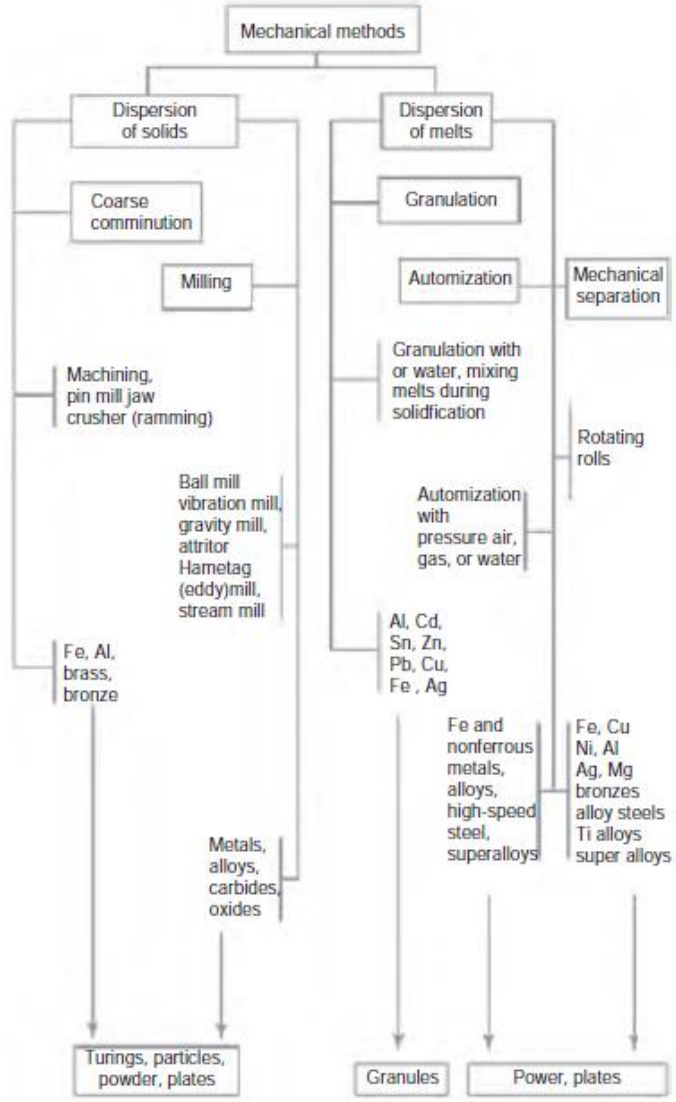


Fig. 2 Mechanical methods of powder production. Source: Ref 4

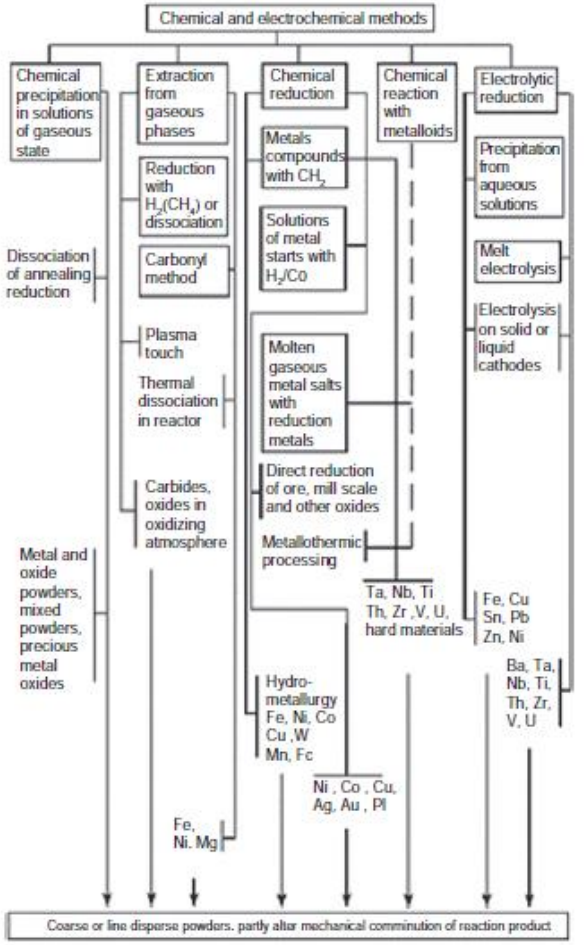


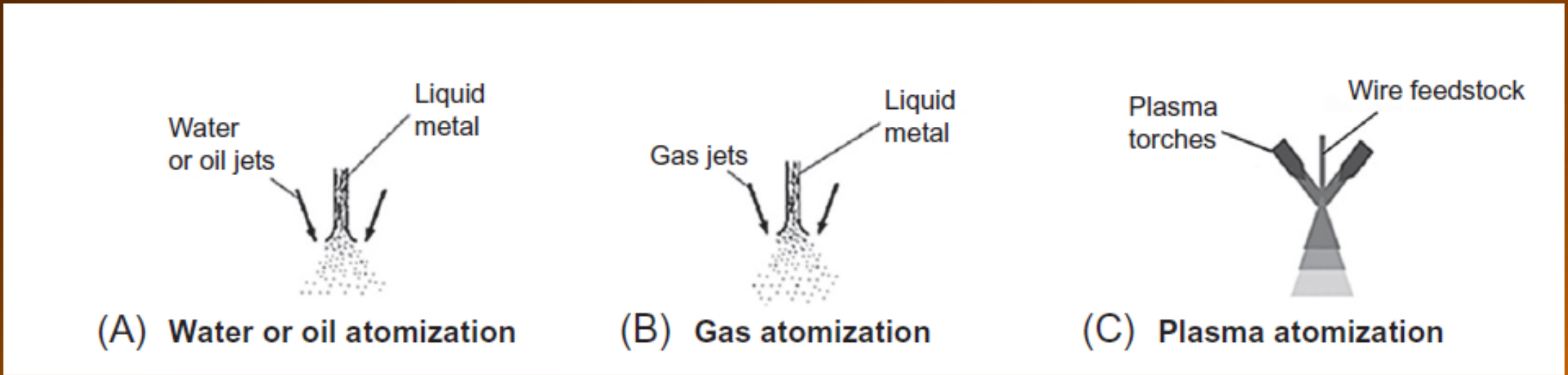
Fig. 3 Chemical and electrochemical methods of powder production. Source: Ref 4

DIRECTED ENERGY DEPOSITION – Metal Powder

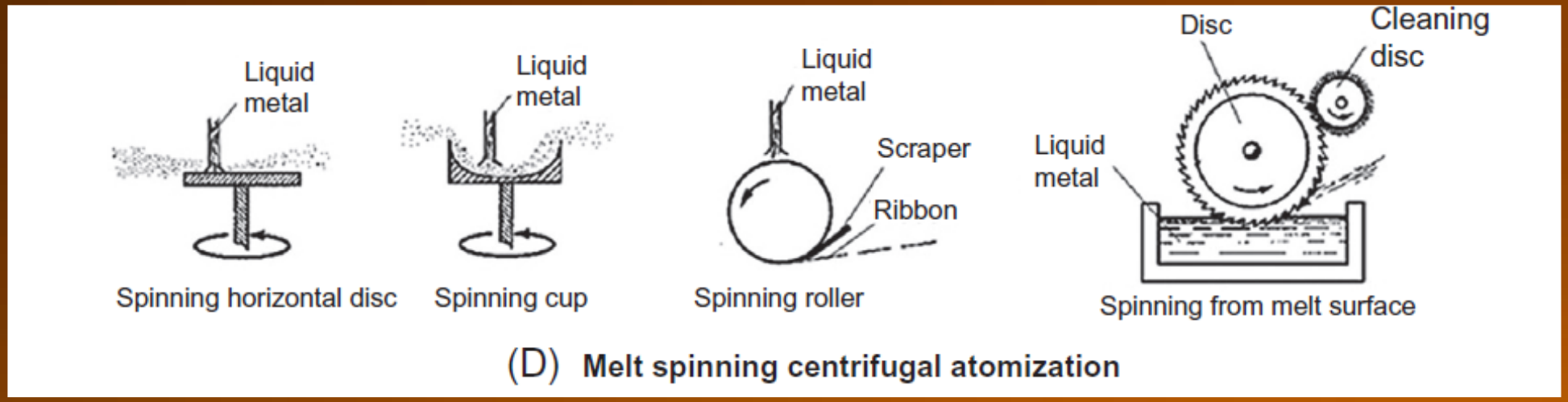
Métodos de produção de pó

- Water atomization
- Gas atomization
- Vacuum atomization
- Centrifugal atomization
- Rotating disk atomization
- Ultrasonic atomization

Métodos de produção de pó

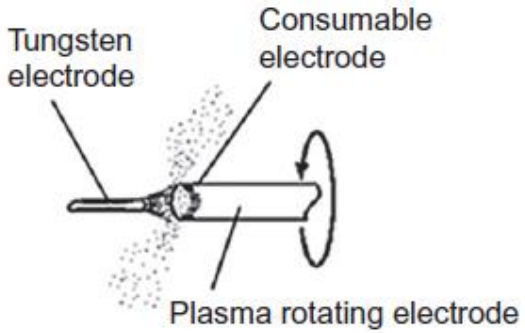


Métodos de produção de pó

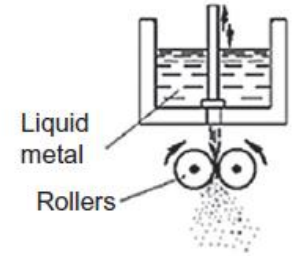


(D) **Melt spinning centrifugal atomization**

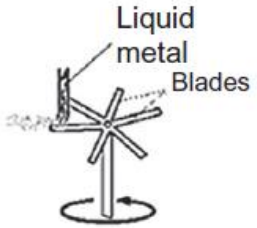
Métodos de produção de pó



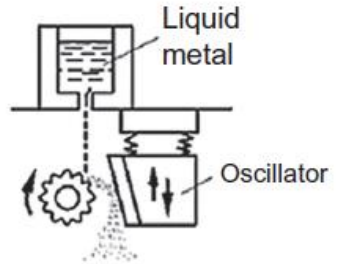
(E) Centrifugal atomization



(G) Mechanical crushing of liquid

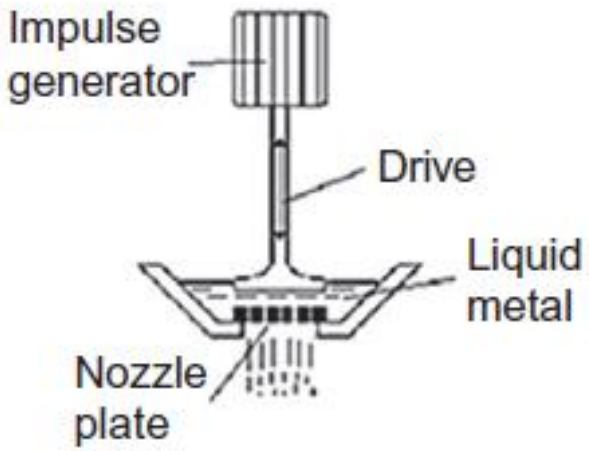


(H) Impact atomization

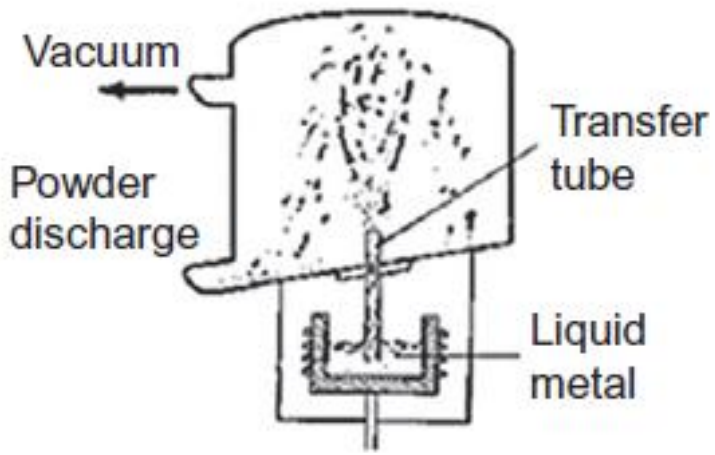


(I) Ultrasonic atomization vibrator

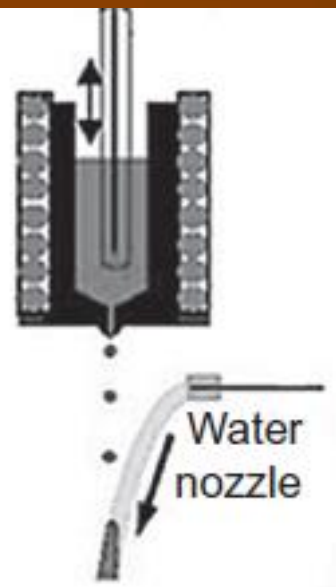
Métodos de produção de pó



(J) Impulse atomization



(K) Vacuum (soluble gas) atomization

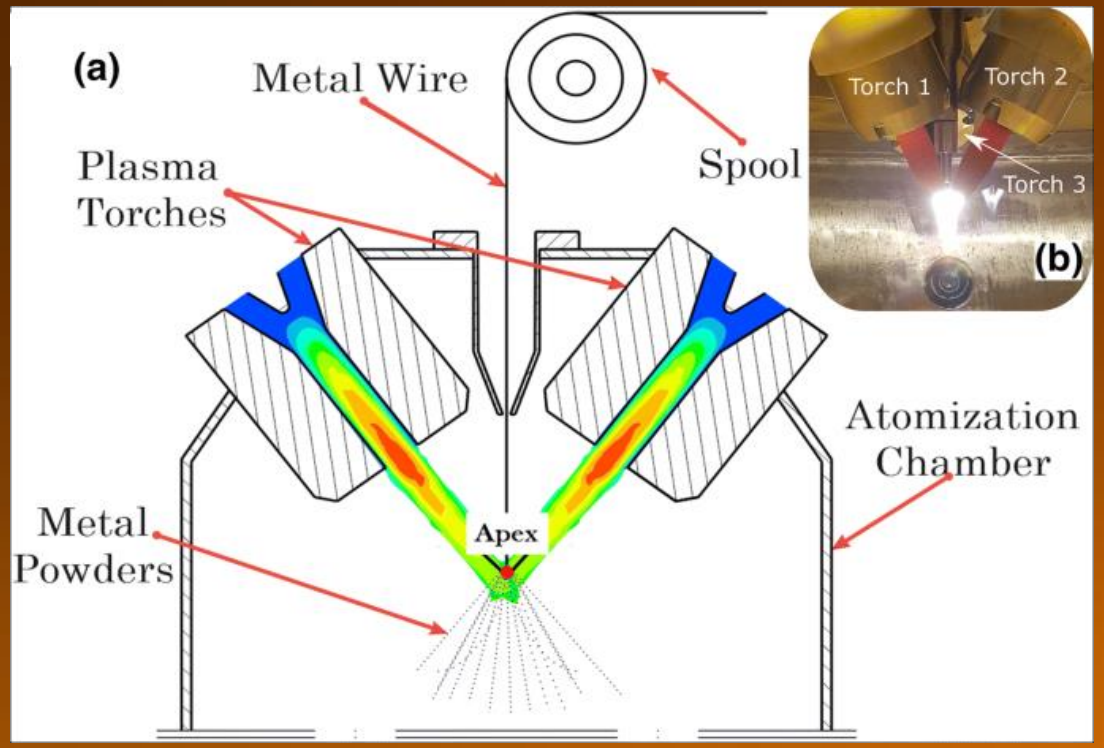


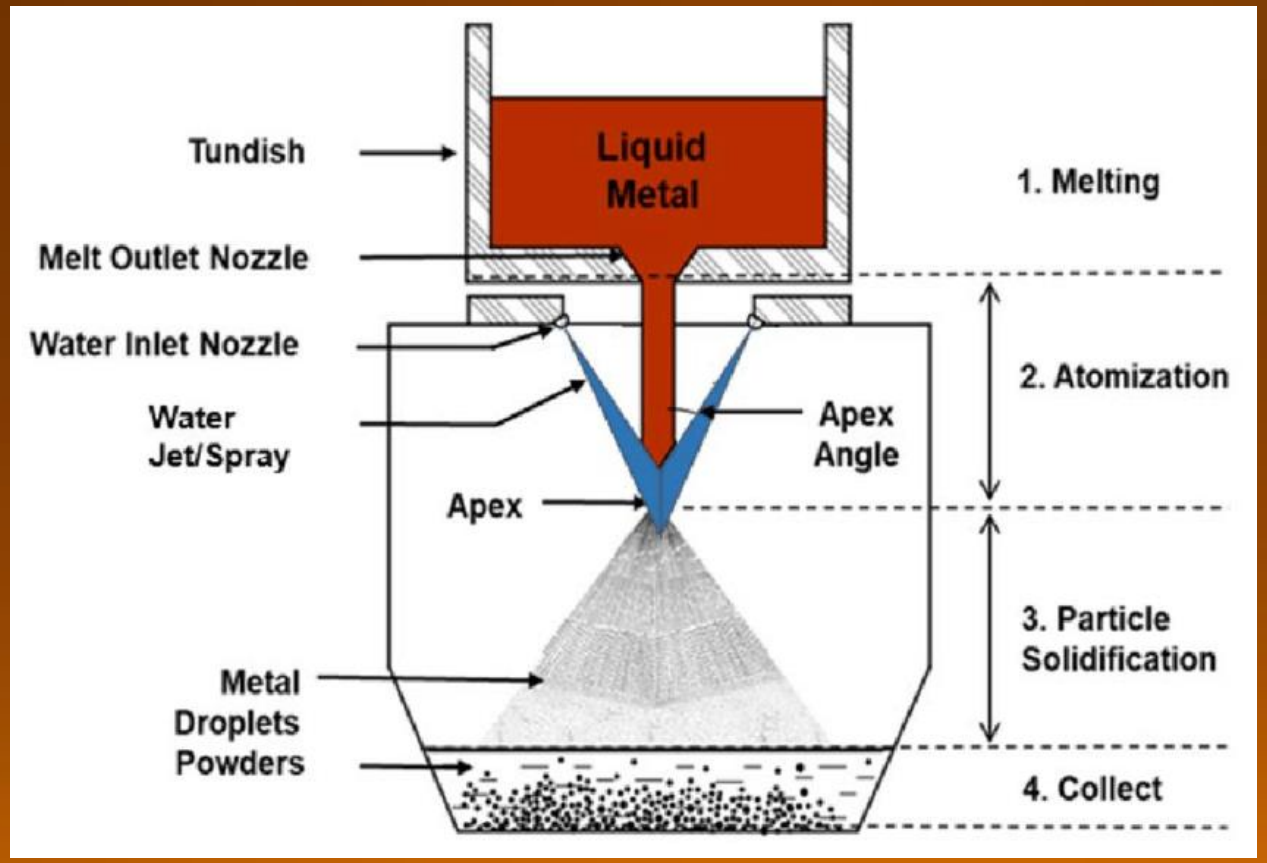
(L) Drops explosion

DIRECTED ENERGY DEPOSITION – Metal Powder

Métodos de produção de pó

Usando Plama e arame



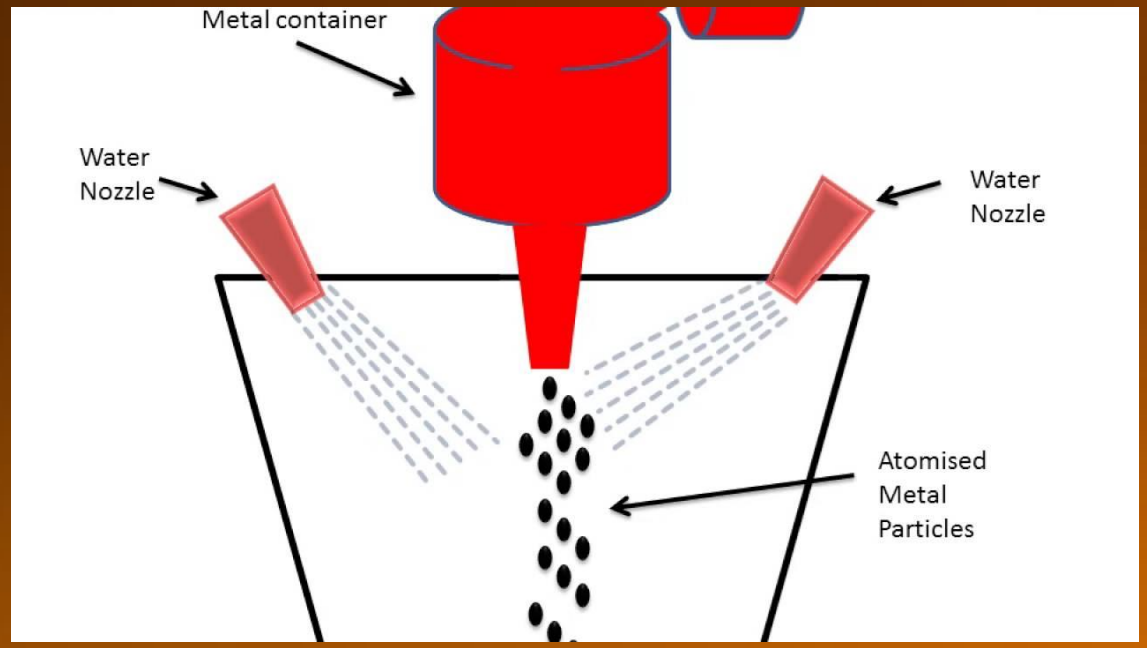


Usando Metal fundido e gas

DIRECTED ENERGY DEPOSITION – Metal Powder

Métodos de produção de pó

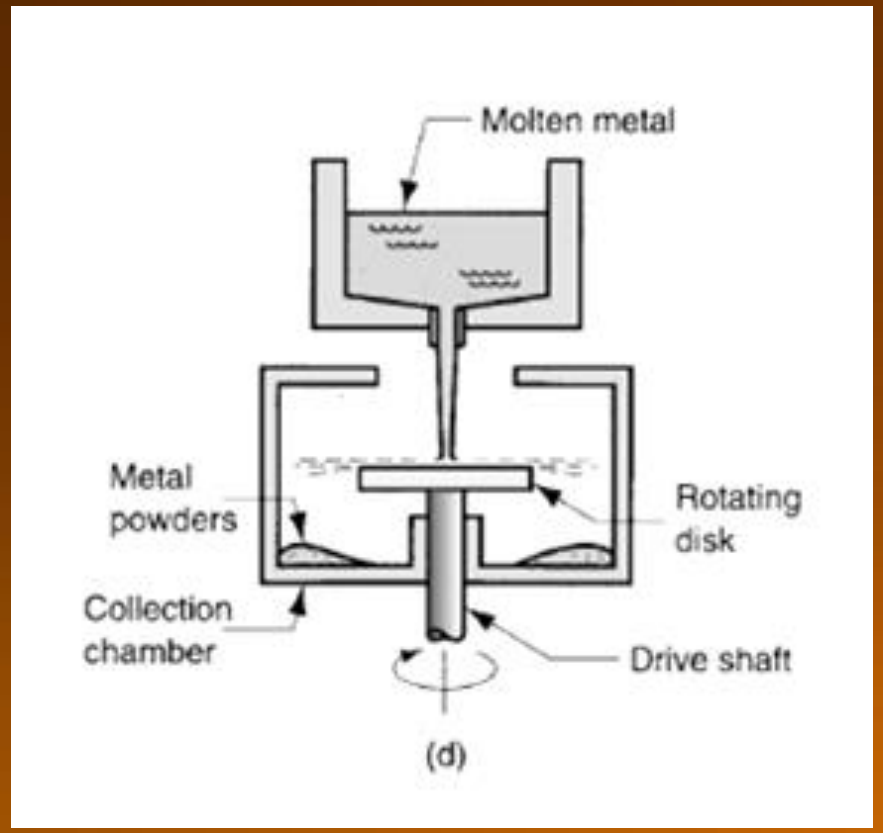
Usando água e metal fundido

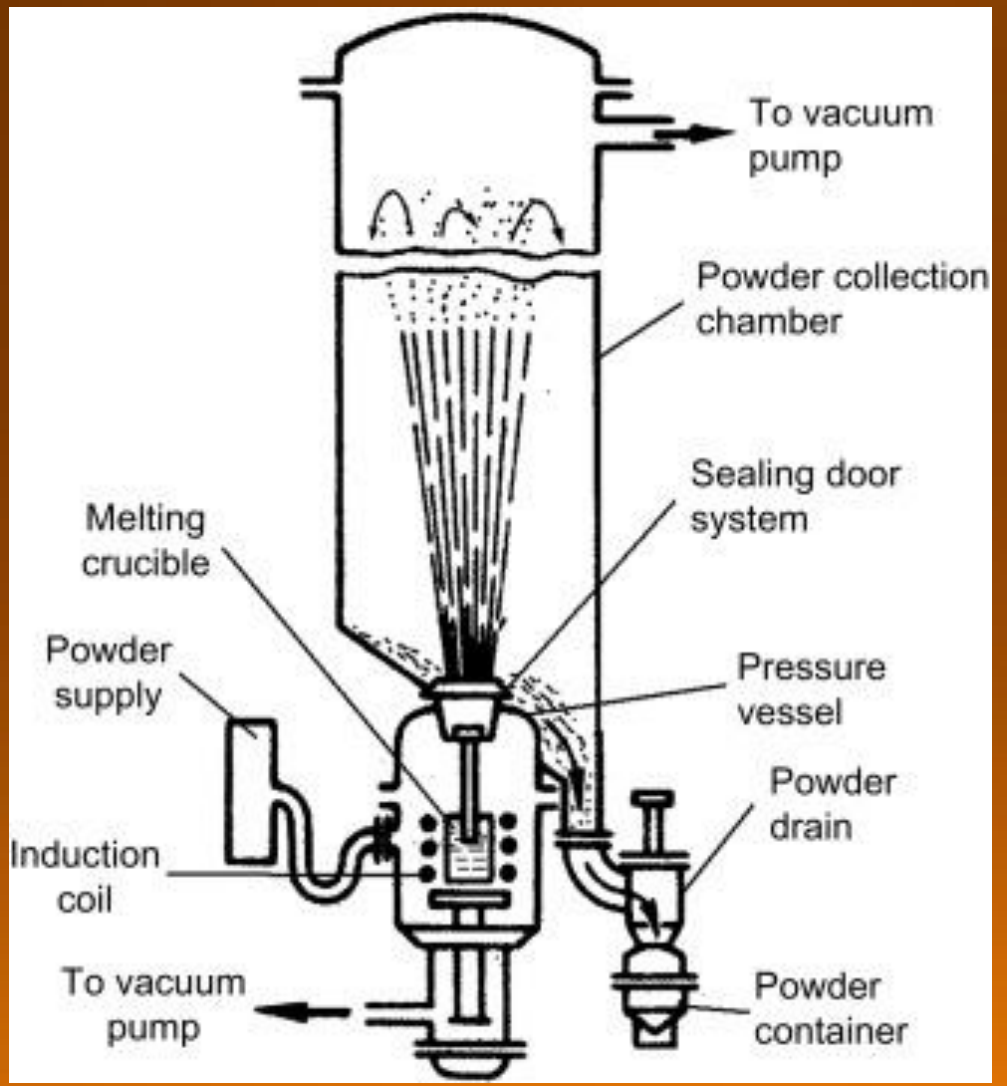


DIRECTED ENERGY DEPOSITION – Metal Powder

Métodos de produção de pó

Método disco rotativo

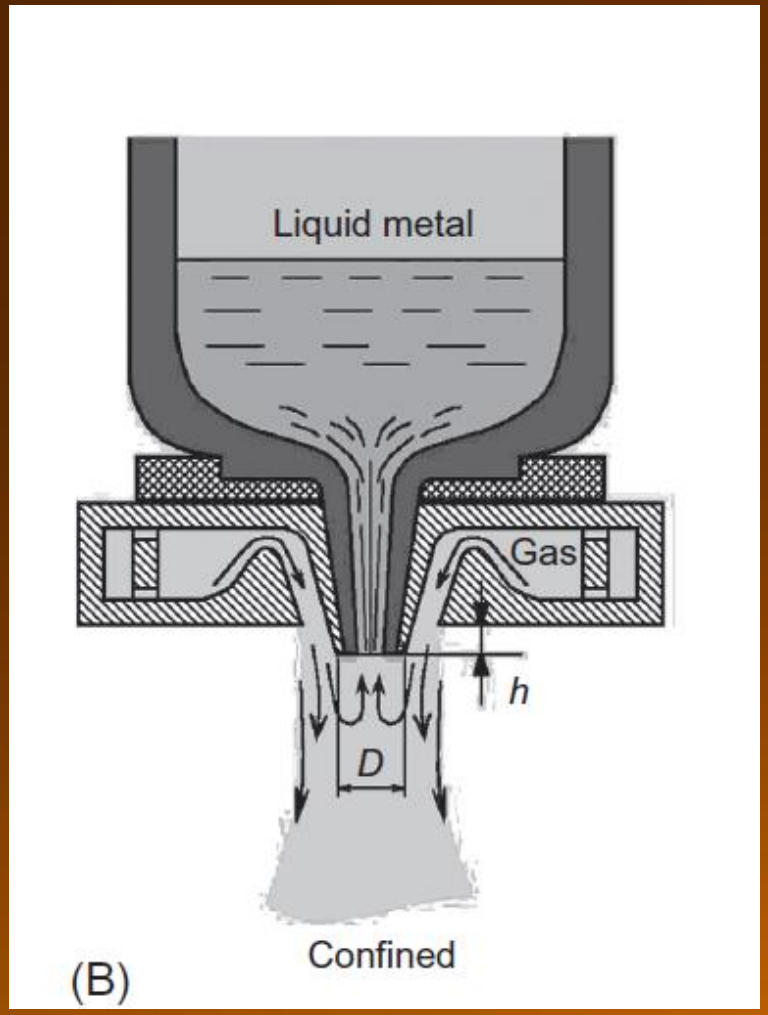


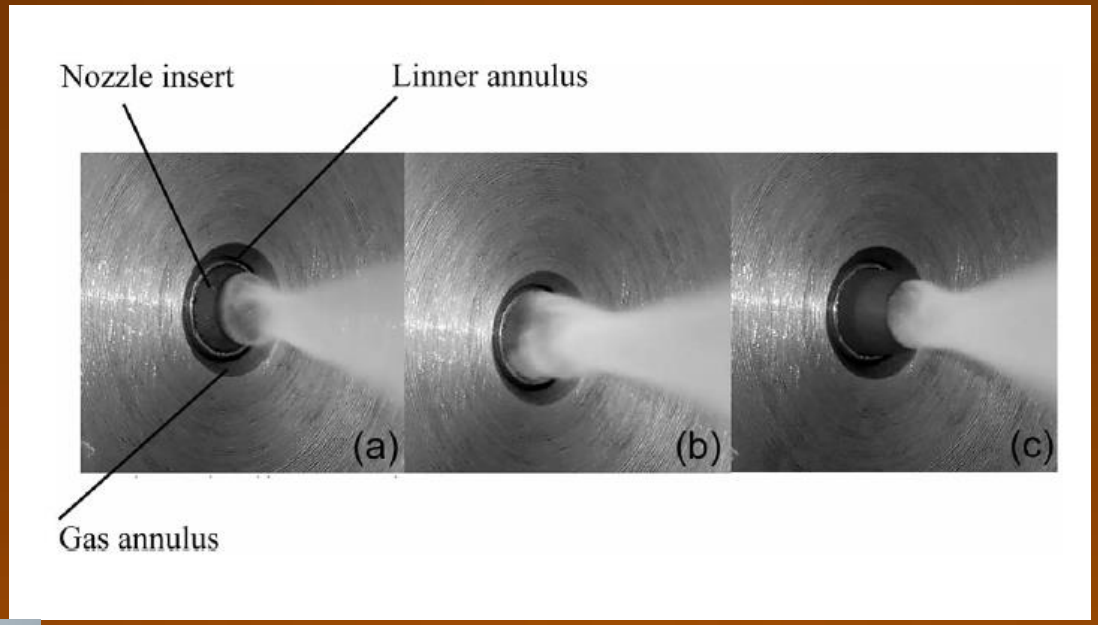


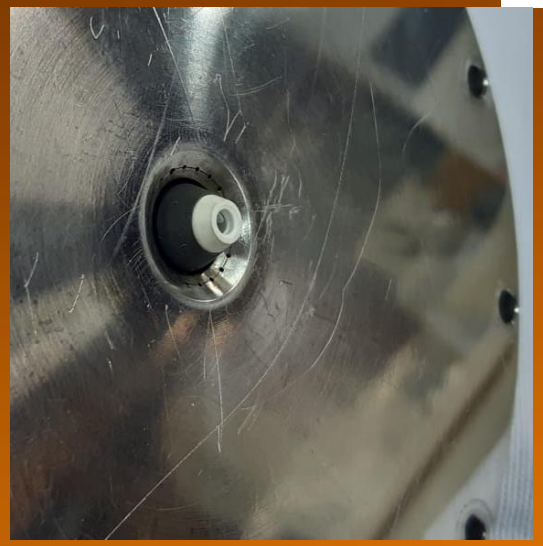
Método inverso

DIRECTED ENERGY DEPOSITION – Metal Powder

Nozzles de atomização

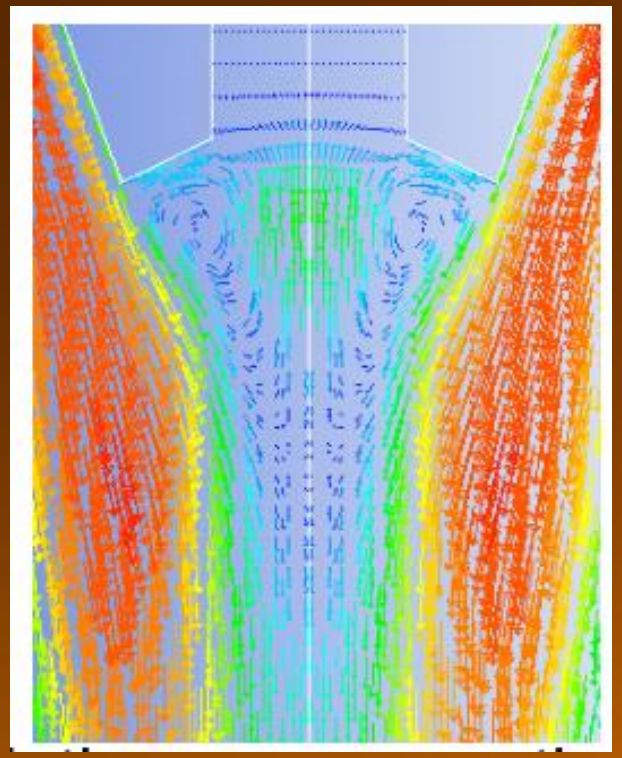




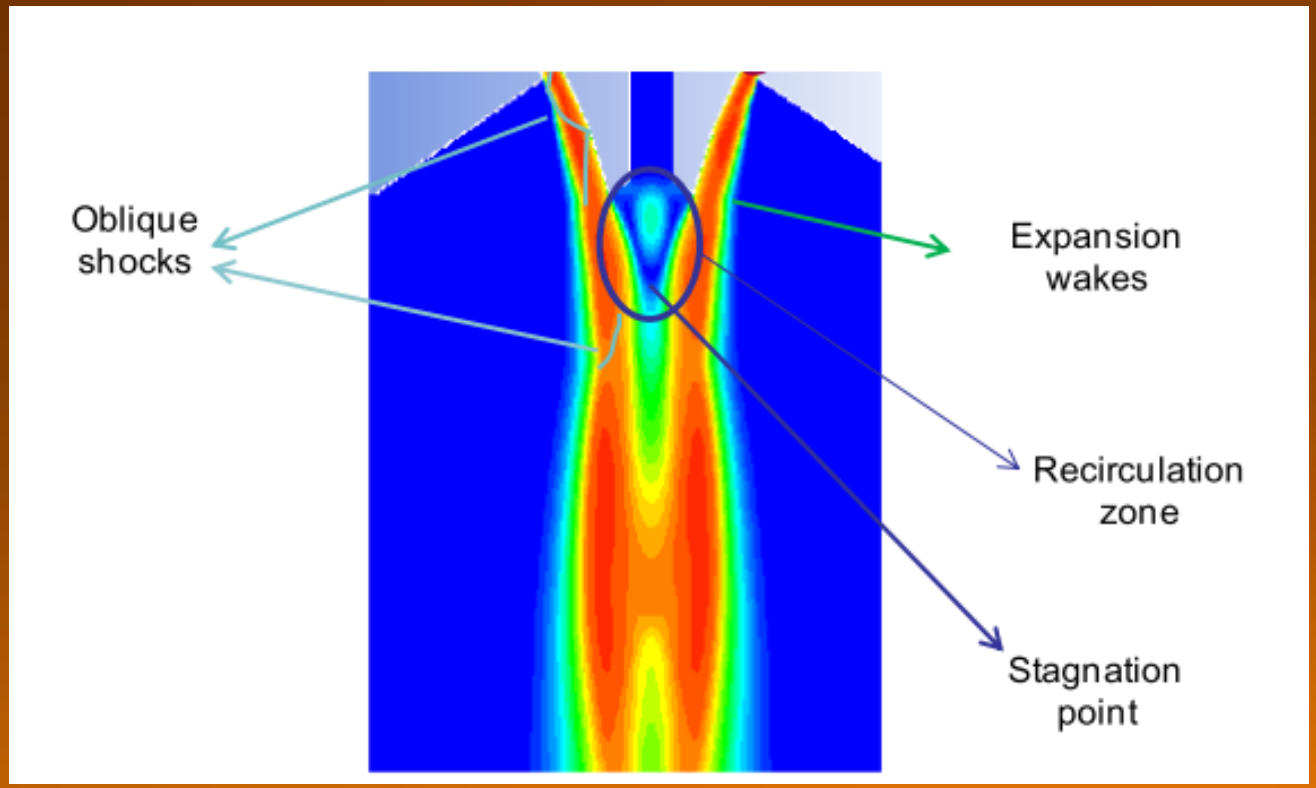


Nozzle do IPT

DIRECTED ENERGY DEPOSITION – Metal Powder

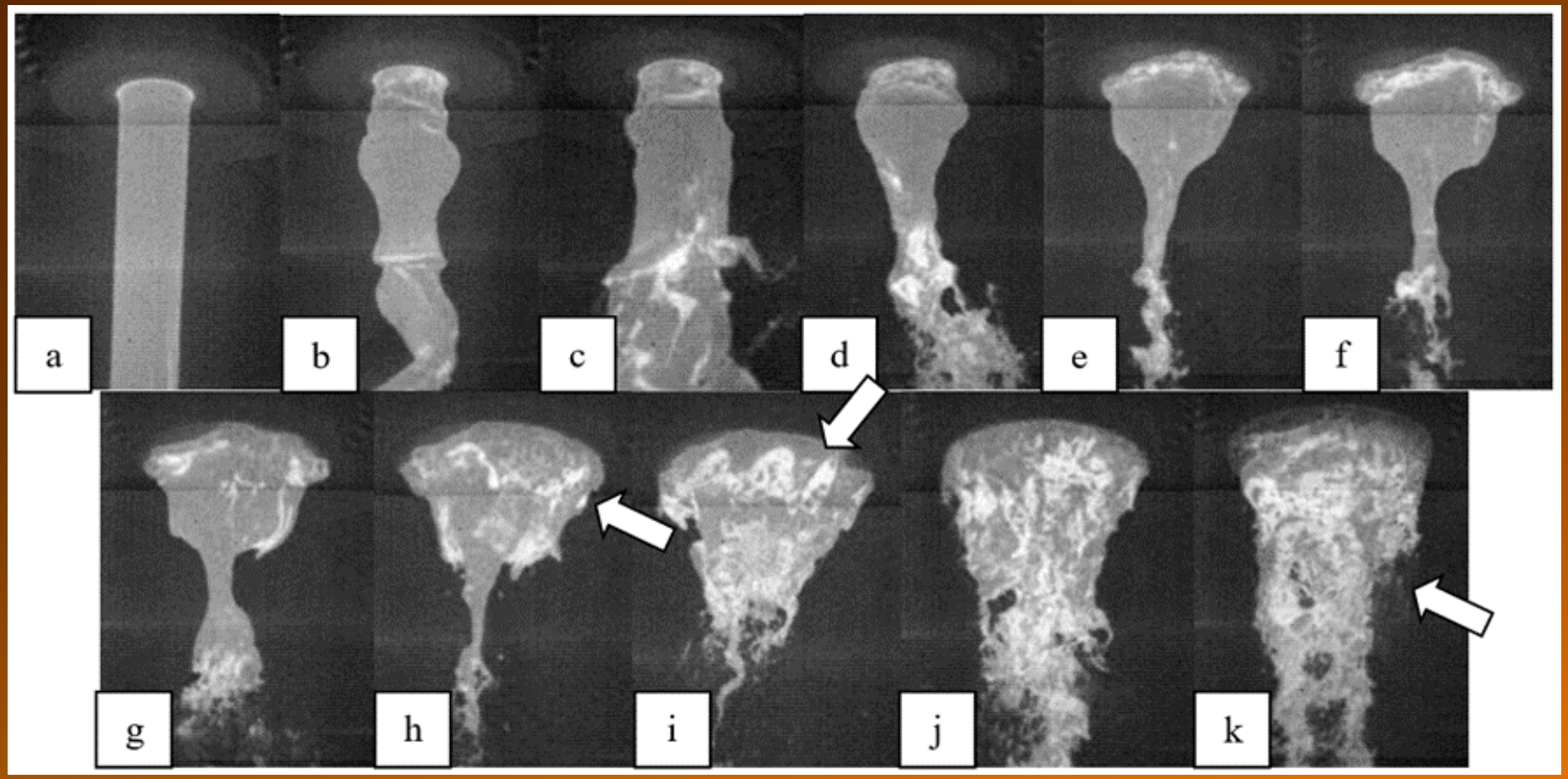


Simulação de atomização



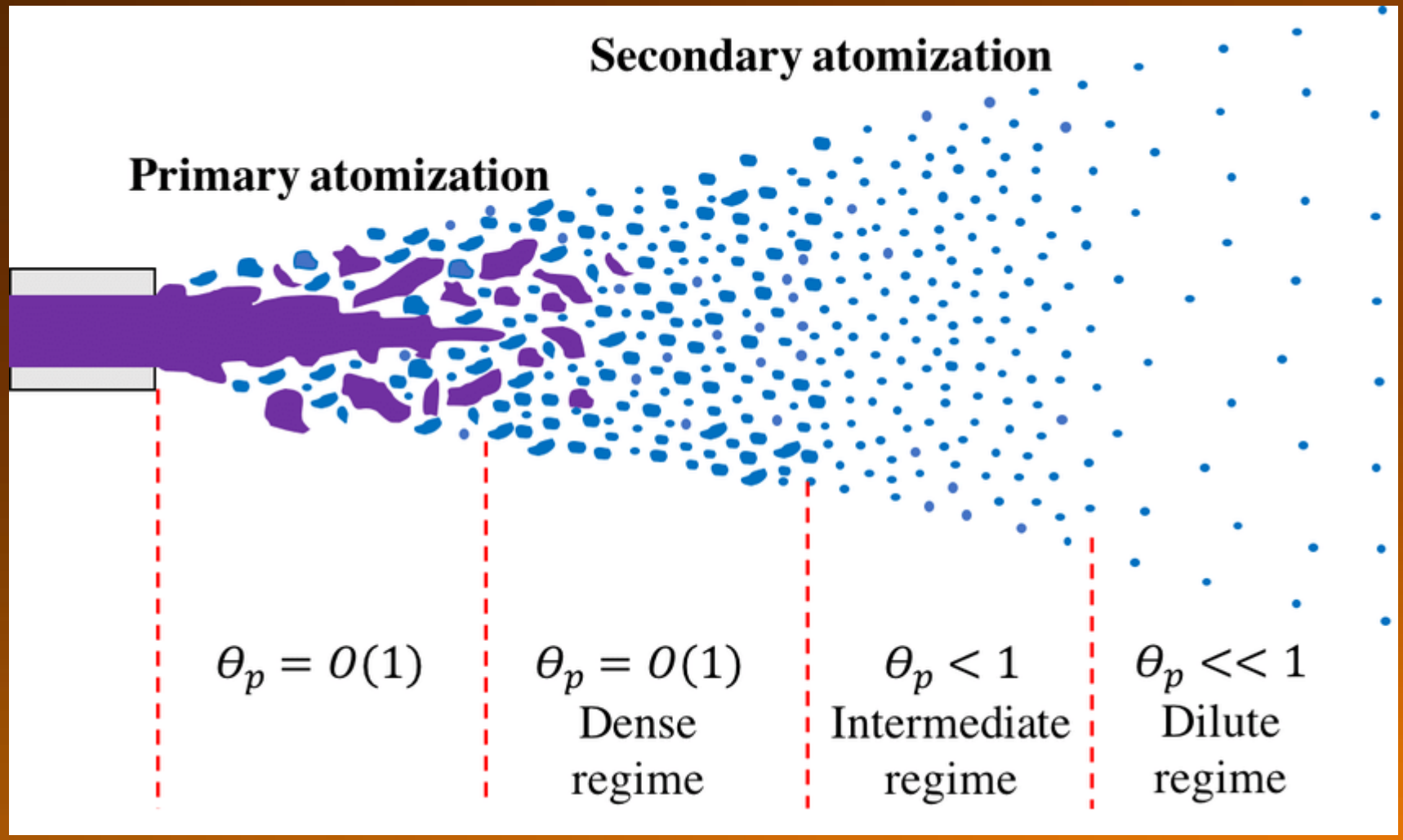
DIRECTED ENERGY DEPOSITION – Metal Powder

Simulação de atomização



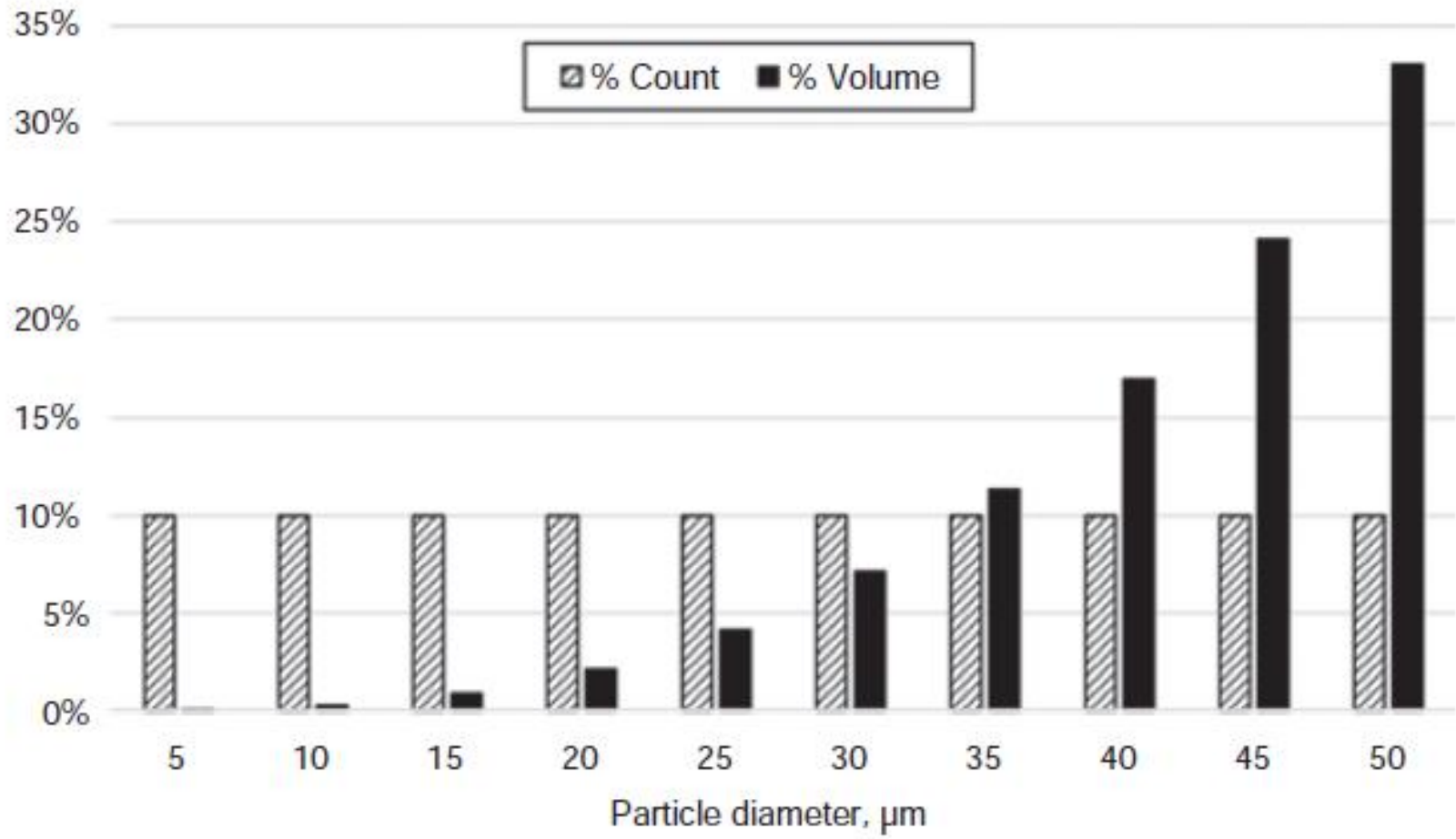
DIRECTED ENERGY DEPOSITION – Metal Powder

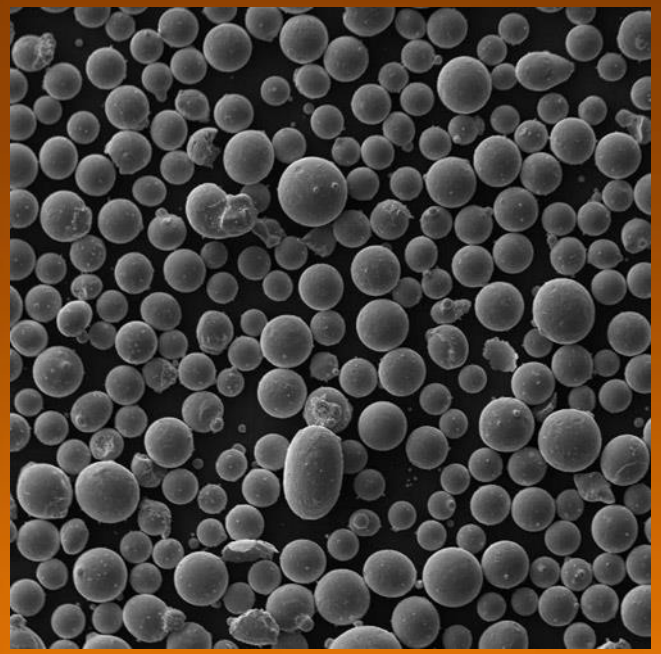
Modelo de atomização



DIRECTED ENERGY DEPOSITION – Metal Powder

Powder characterization

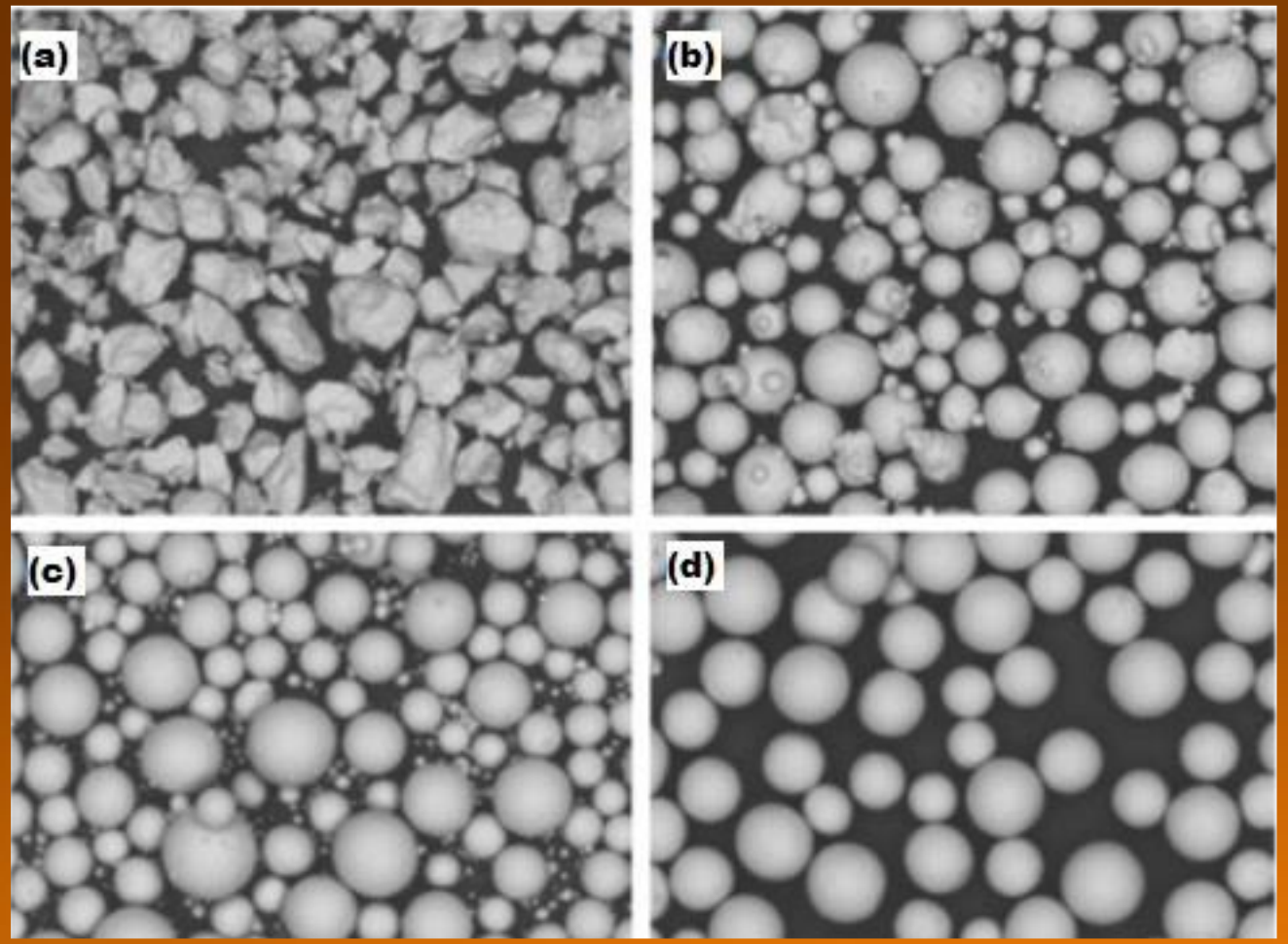




DIRECTED ENERGY DEPOSITION – Metal Powder

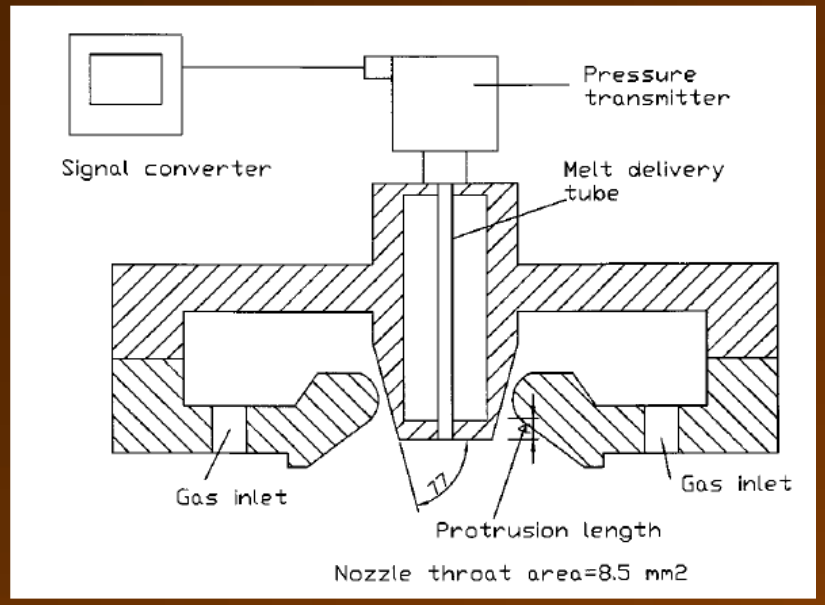
Aspects of several atomization techniques

(a) the HDH-hydrate-dehydrate process;
(b) gas atomisation;
(c) plasma atomisation;
(d) the plasma rotatin

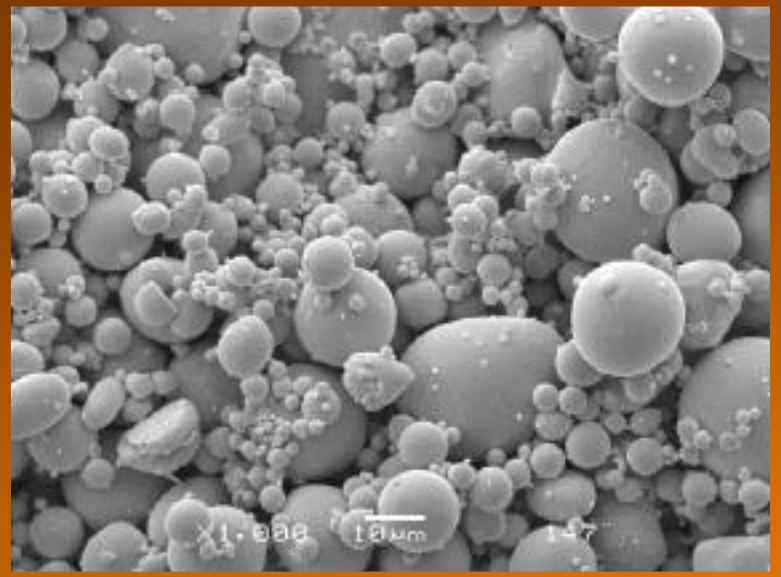


PROCESSOS DE MANUFATURA ADITIVA

DIRECTED ENERGY DEPOSITION – Metal Powder



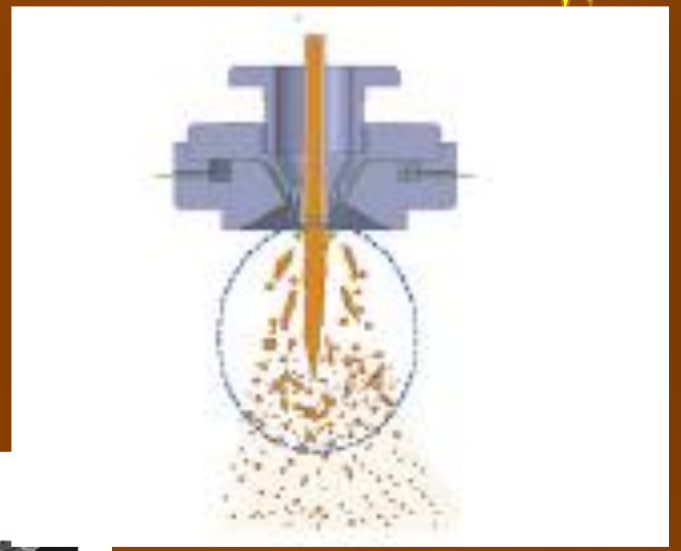
Example



PROCESSOS DE MANUFATURA ADITIVA

DIRECTED ENERGY DEPOSITION – Metal Powder

Example



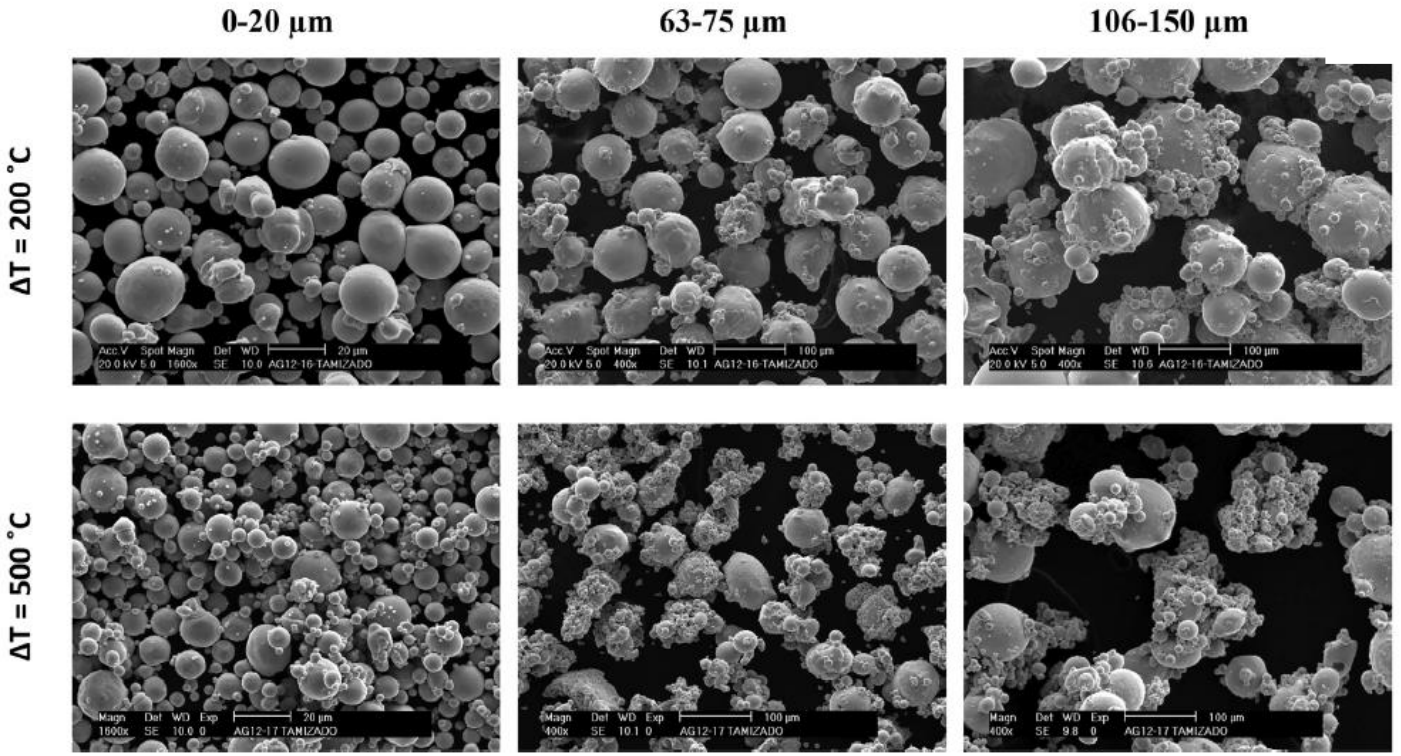
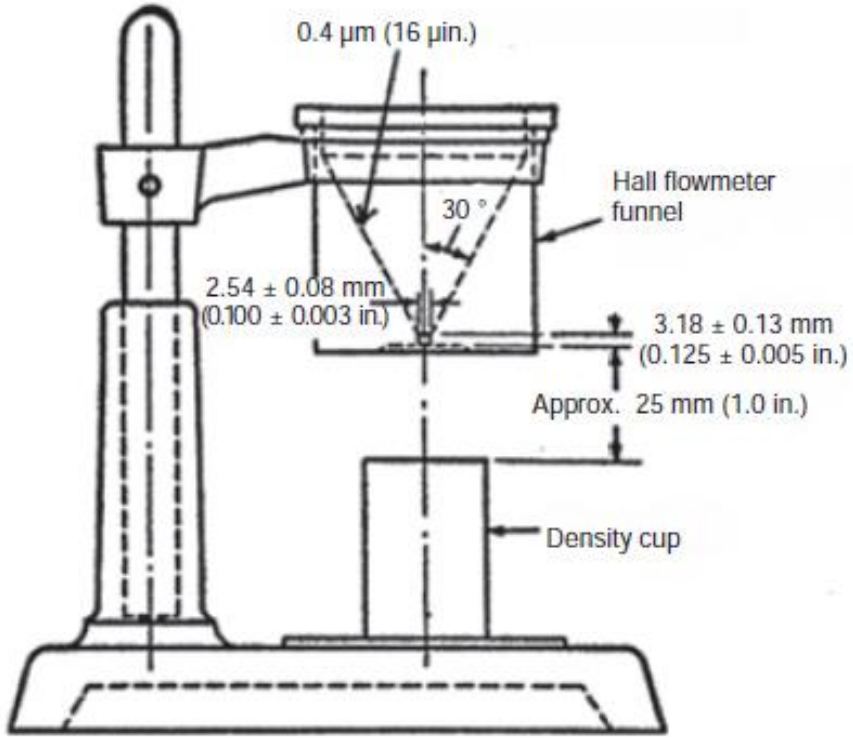


Fig. 11. Micrographs from different size fractions of two Cu powders obtained applying different melt superheats (gas N_2, $P = 50$ bar, $\Delta P = 0.25$ bar and throat width $= 0.77\ L_o$).

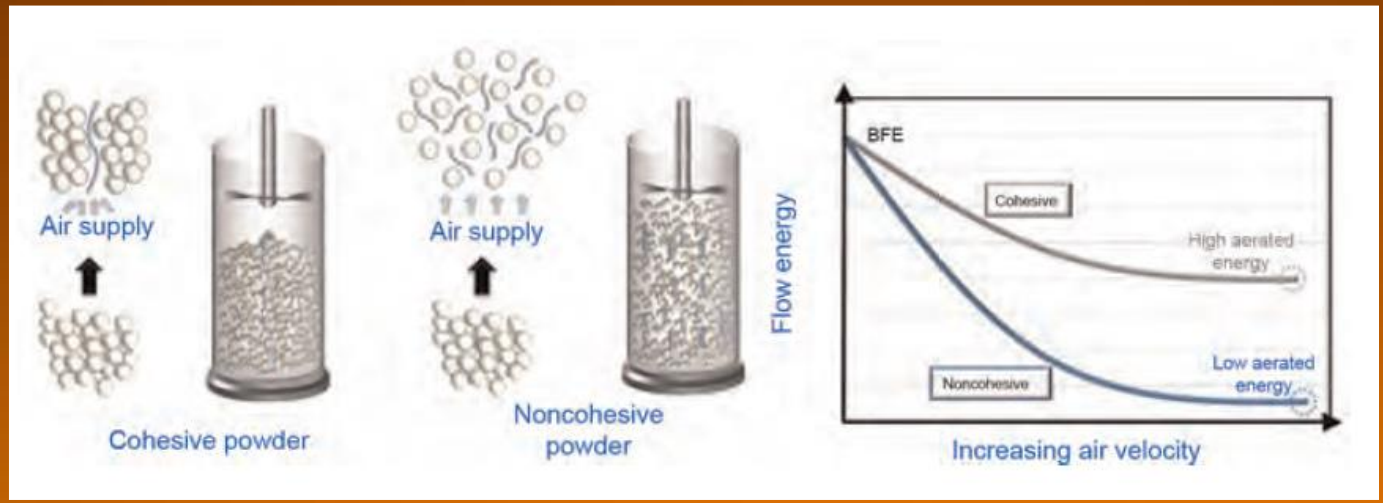
DIRECTED ENERGY DEPOSITION – Metal Powder

Powder Flowability in Metal Additive Manufacturing

Hall/Carney Flow Test



Energy necessary to agitate



DIRECTED ENERGY DEPOSITION – Metal Powder

Shear analysis

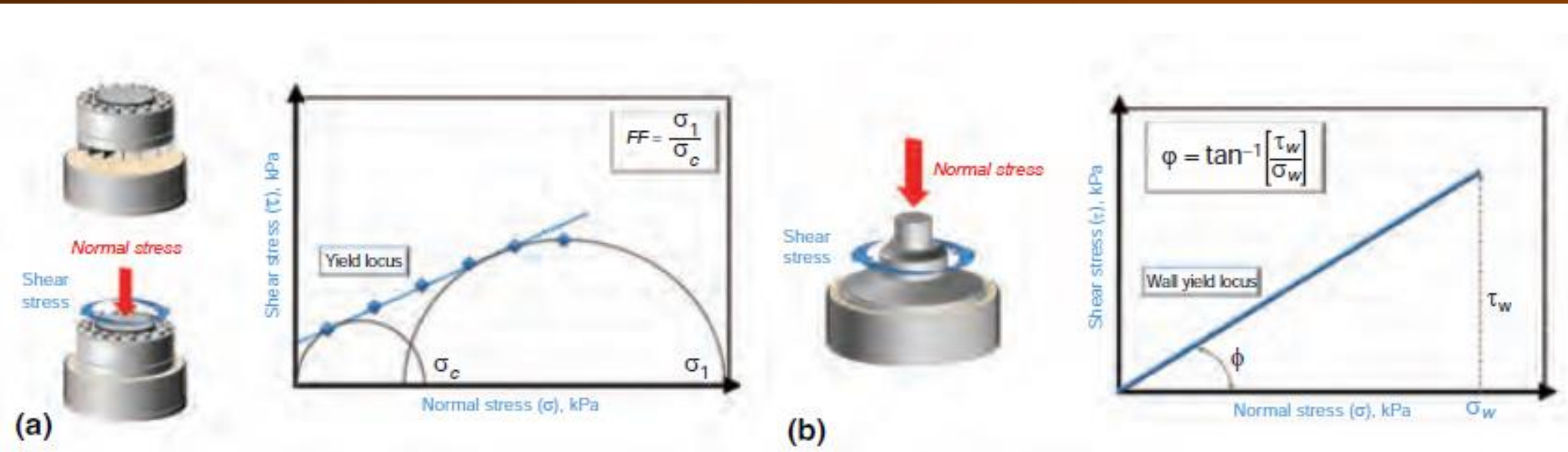


Fig. 6 (a) Shear test analysis. (b) Wall yield locus from shear test. Courtesy of Freeman Technology

DIRECTED ENERGY DEPOSITION – Metal Powder

Shear analysis

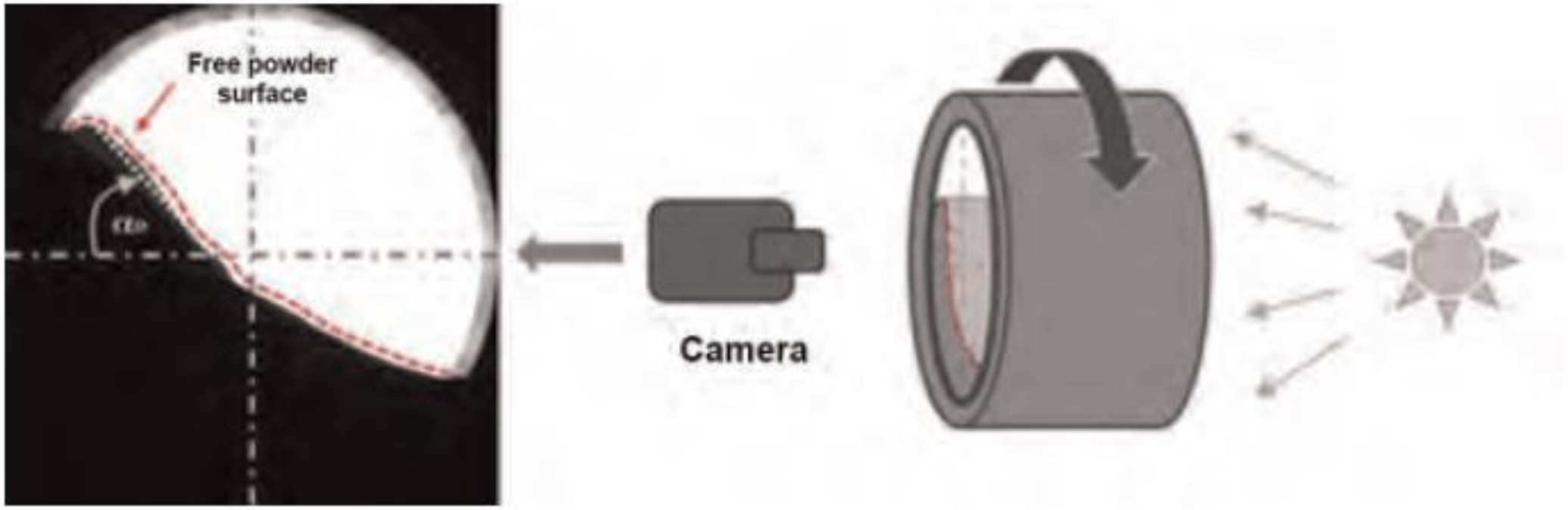
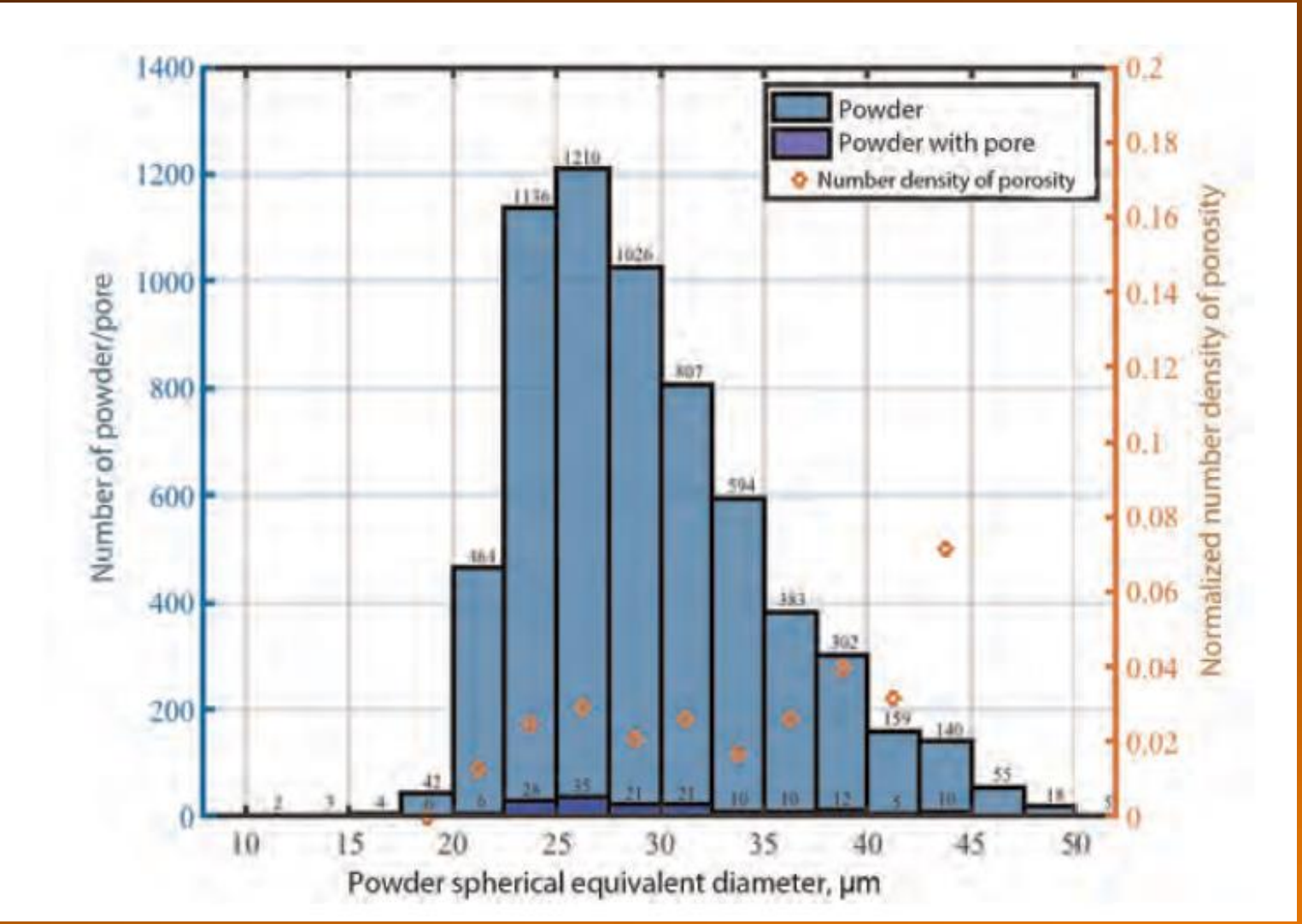


Fig. 7 Schematic of the revolving drum principle. Source: Ref 4

DIRECTED ENERGY DEPOSITION – Metal Powder

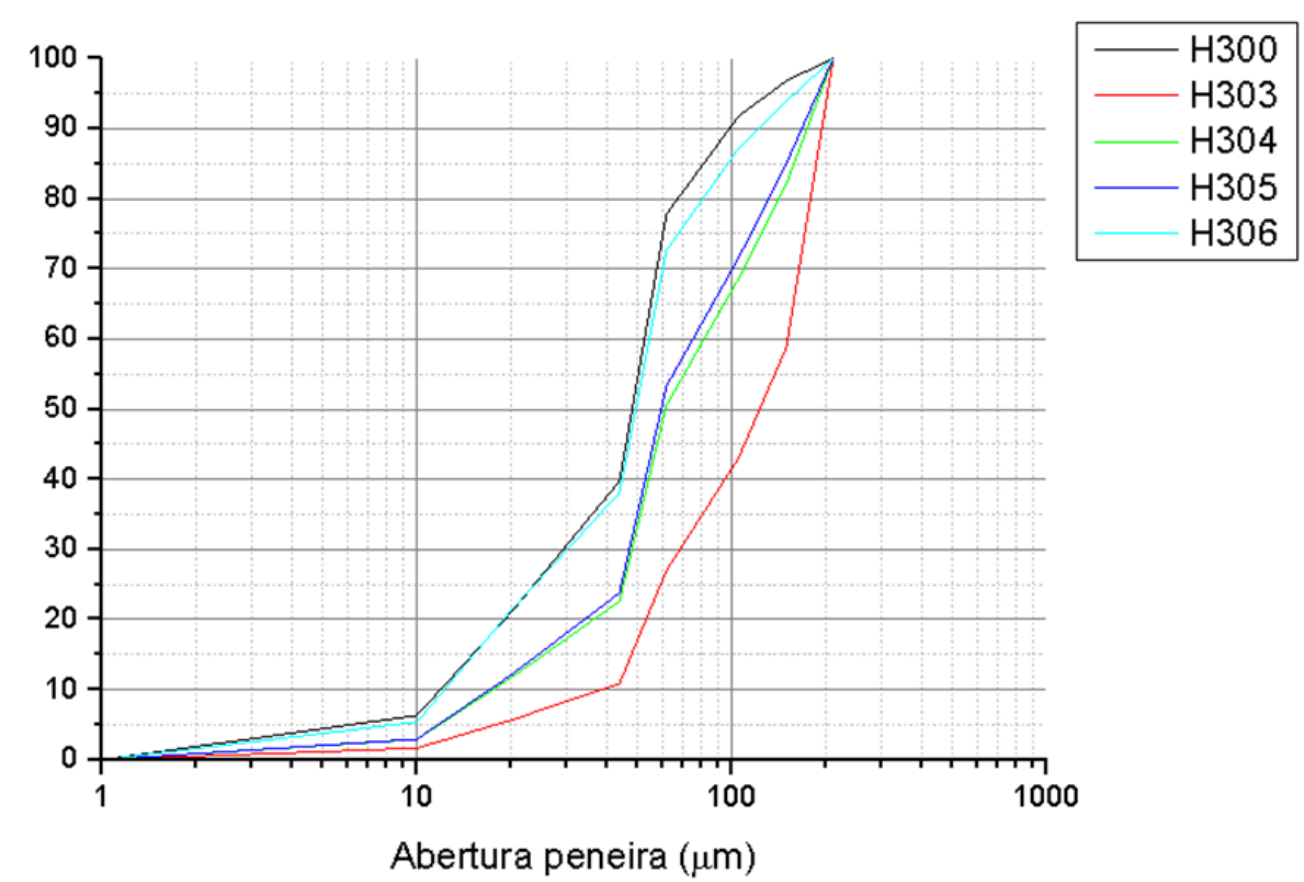
Typical diameter distribution



PROCESSOS DE MANUFATURA ADITIVA

DIRECTED ENERGY DEPOSITION – Metal Powder

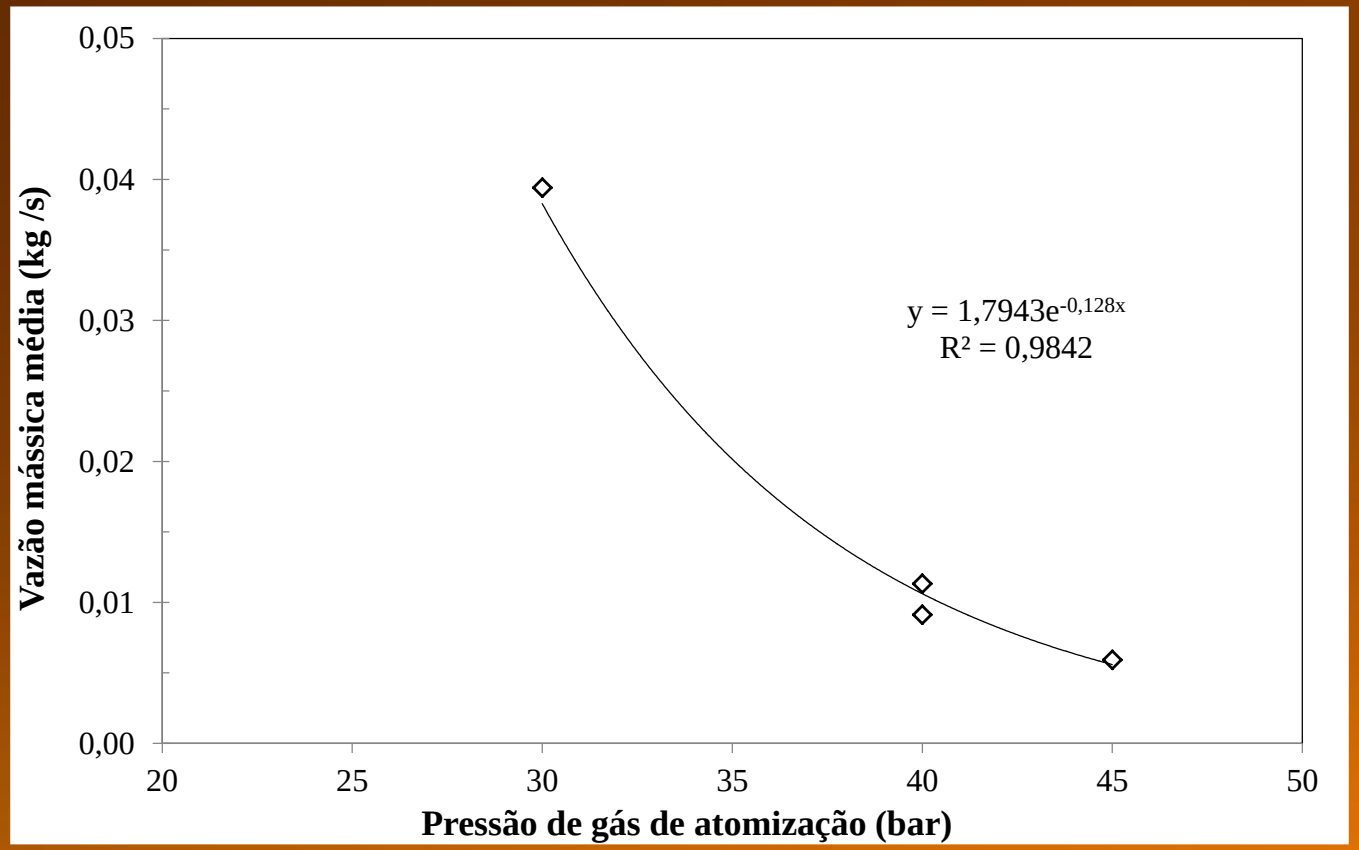
Resultados no IPT – 316L



Experimento	d_0 (m)	Pg (Pa)	Pf (Pa)	Ts (°C)
H303	0,002	2000000	20000	200
H305	0,002	3000000	20000	200
H306	0,002	4000000	30000	200
H304	0,0025	3000000	20000	200
H300	0,0025	4000000	20000	200

DIRECTED ENERGY DEPOSITION – Metal Powder

Resultados no IPT – 316L

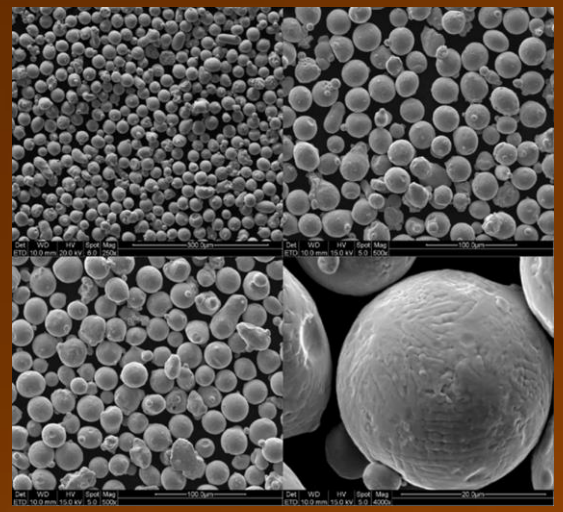


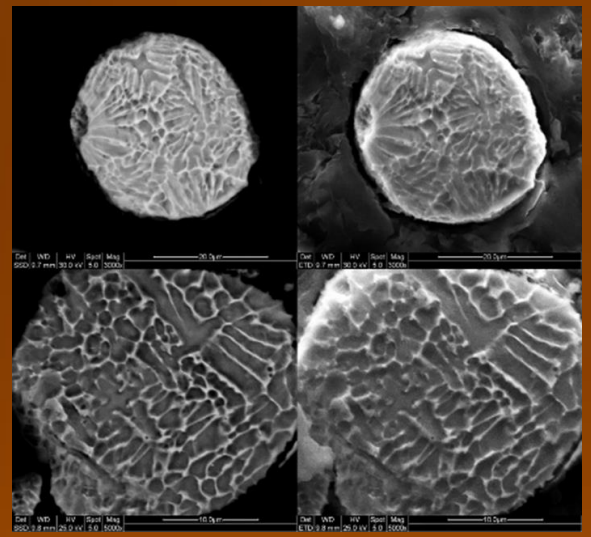
DIRECTED ENERGY DEPOSITION – Metal Powder

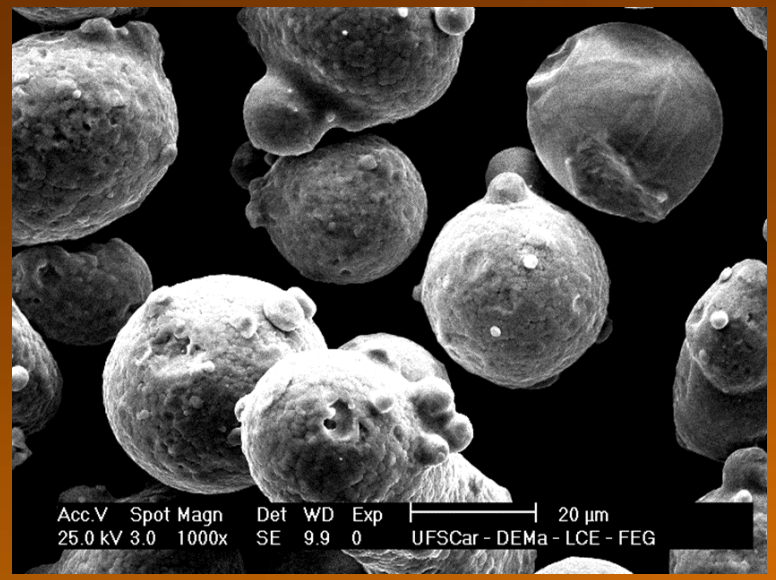
Resultados no IPT – 316L

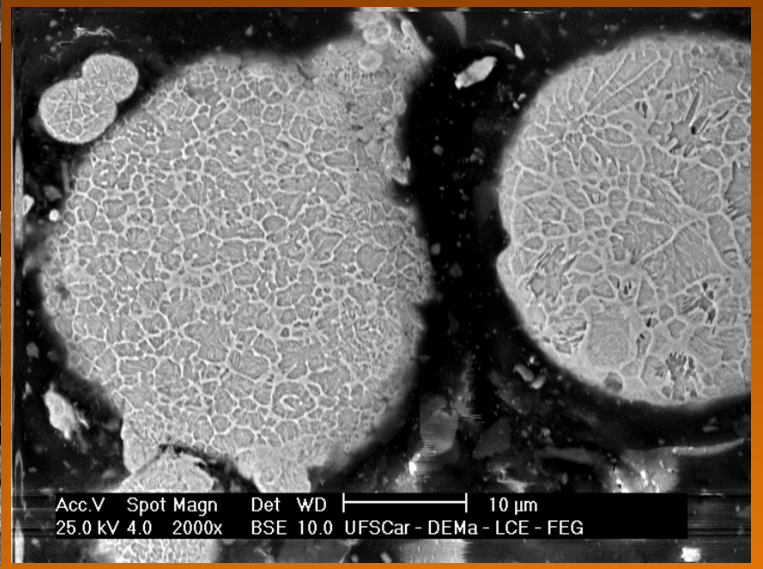
Characterization of the IPT-produced metal powder

AISI 316L – External aspect









AISI 316L – Internal aspects