

Powder production methods

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Powder Production Methods

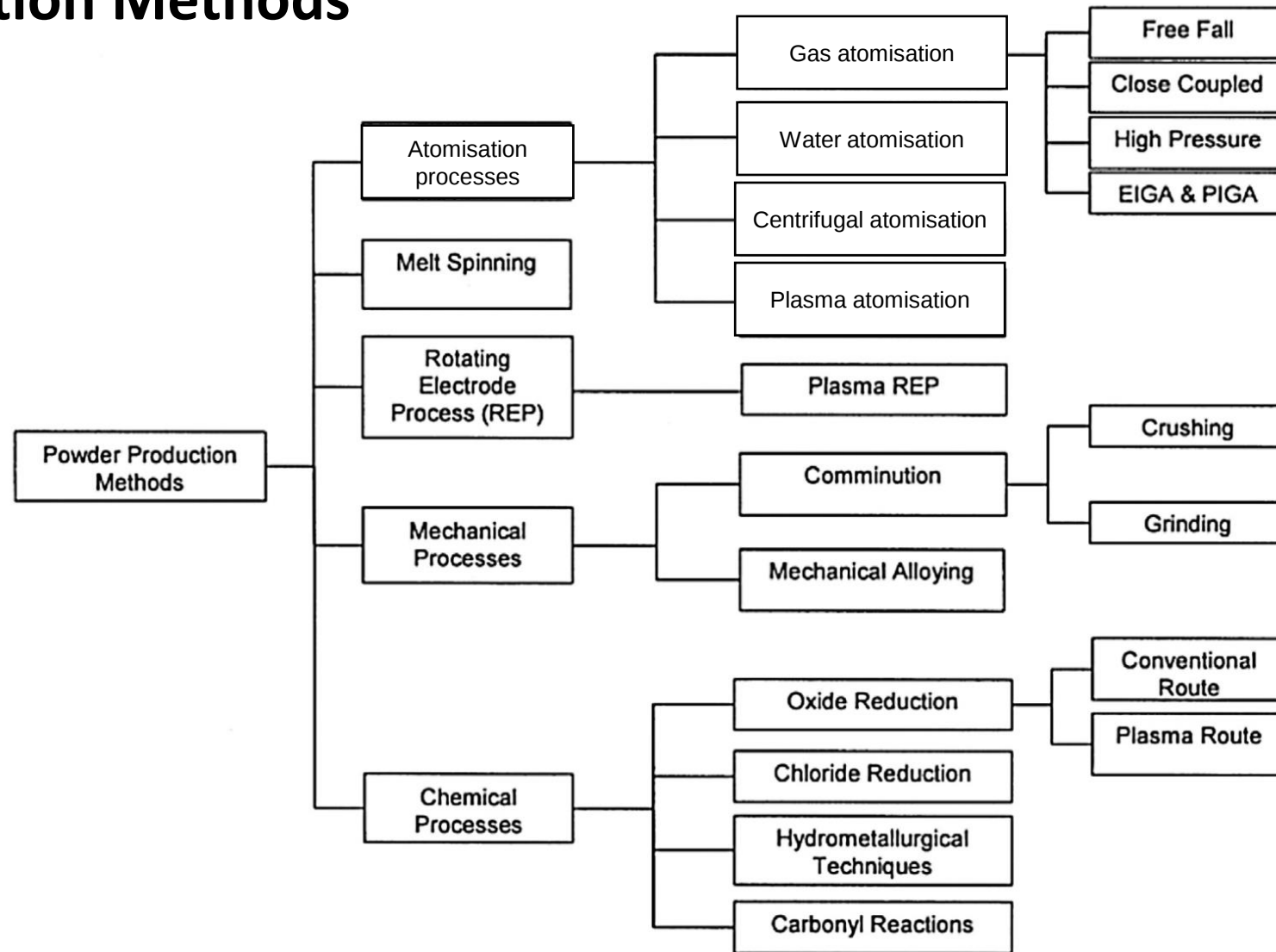


Fig. Powder production methods

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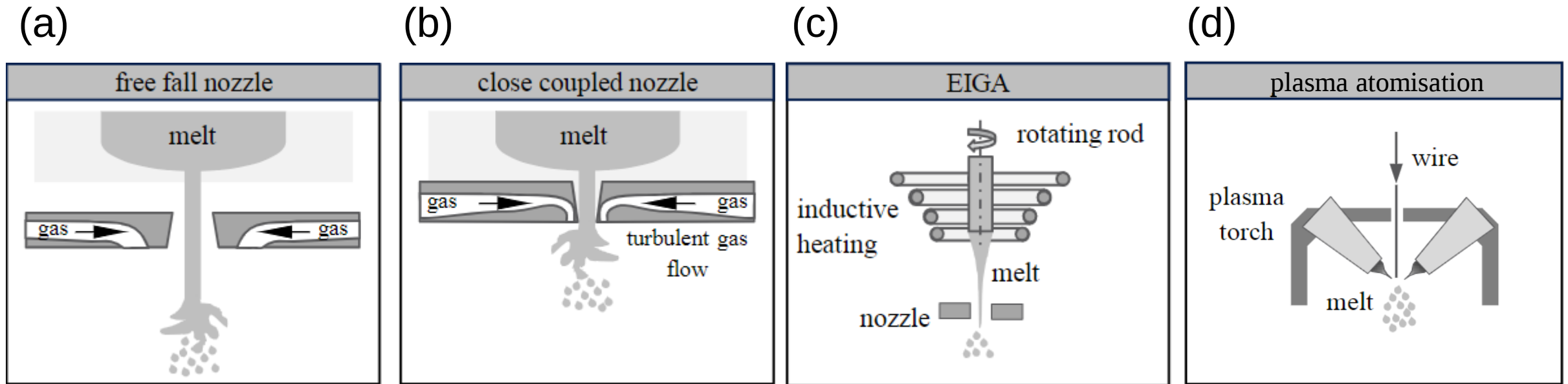


Fig. Nozzle assemblies in gas atomization

Source: Dietrich et al. 2016 [<https://doi.org/10.1016/j.promfg.2016.11.012>]

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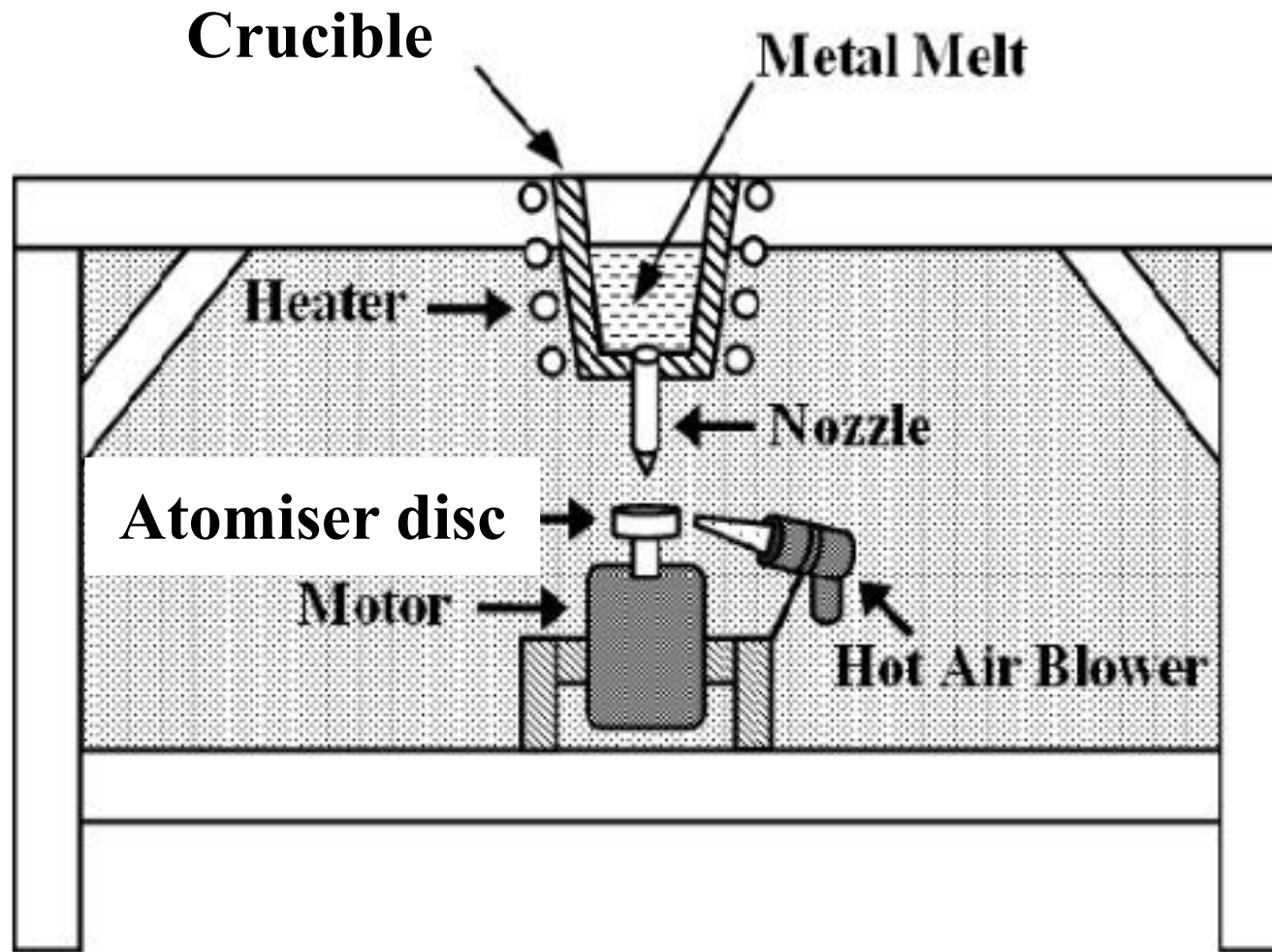
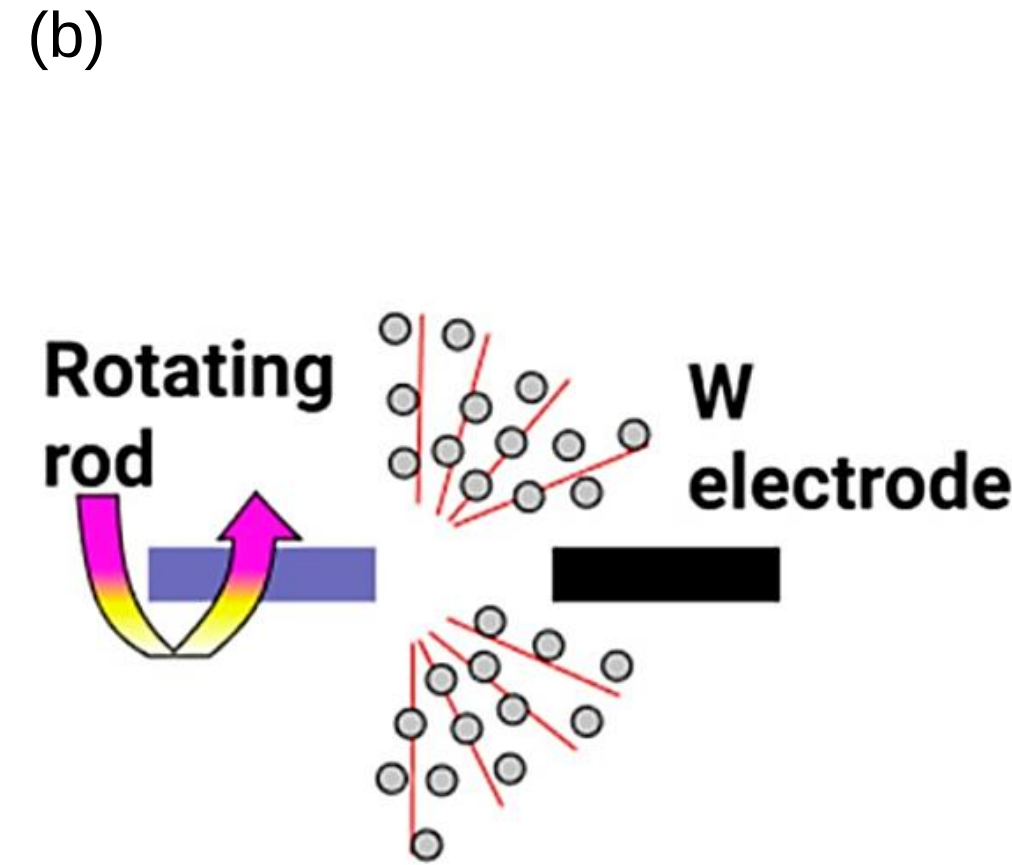
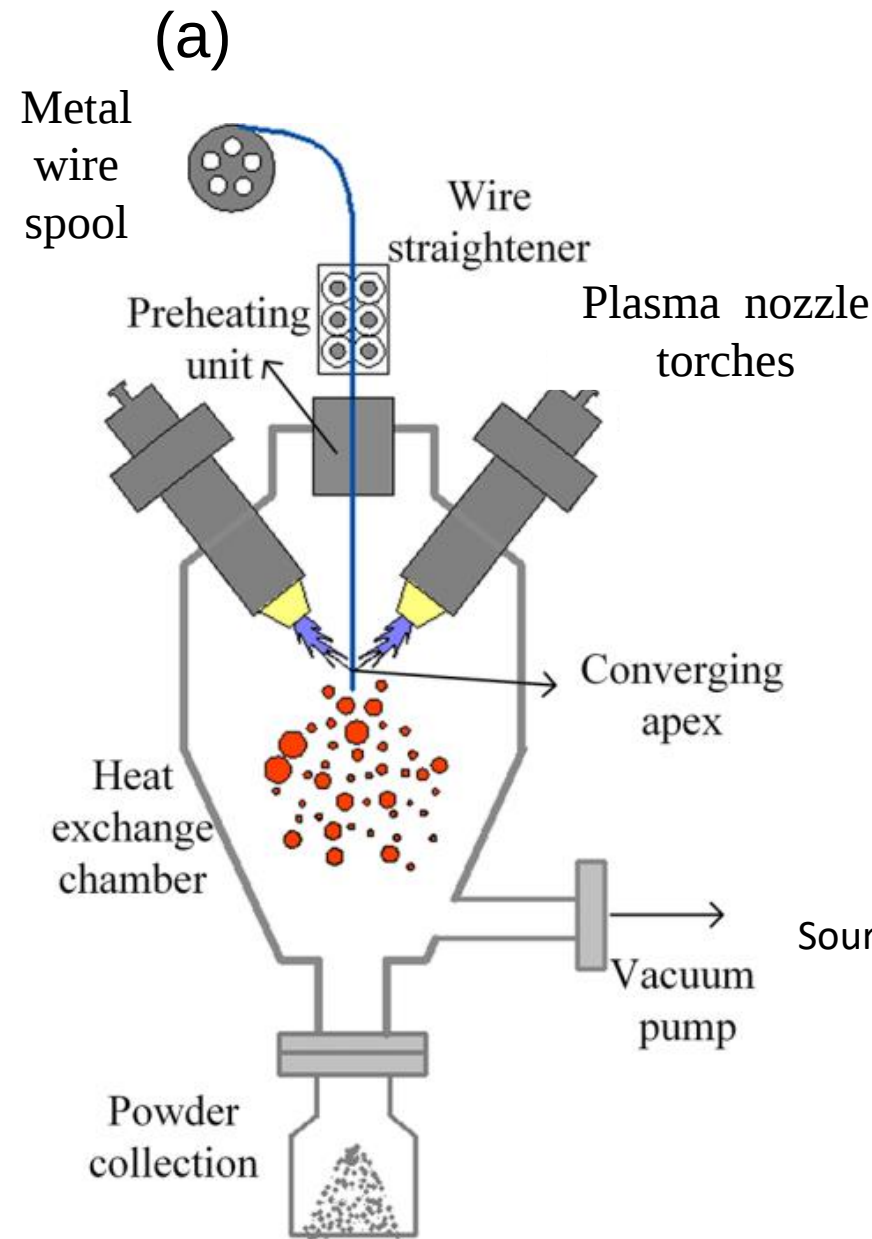


Fig. Centrifugal atomizer schematic

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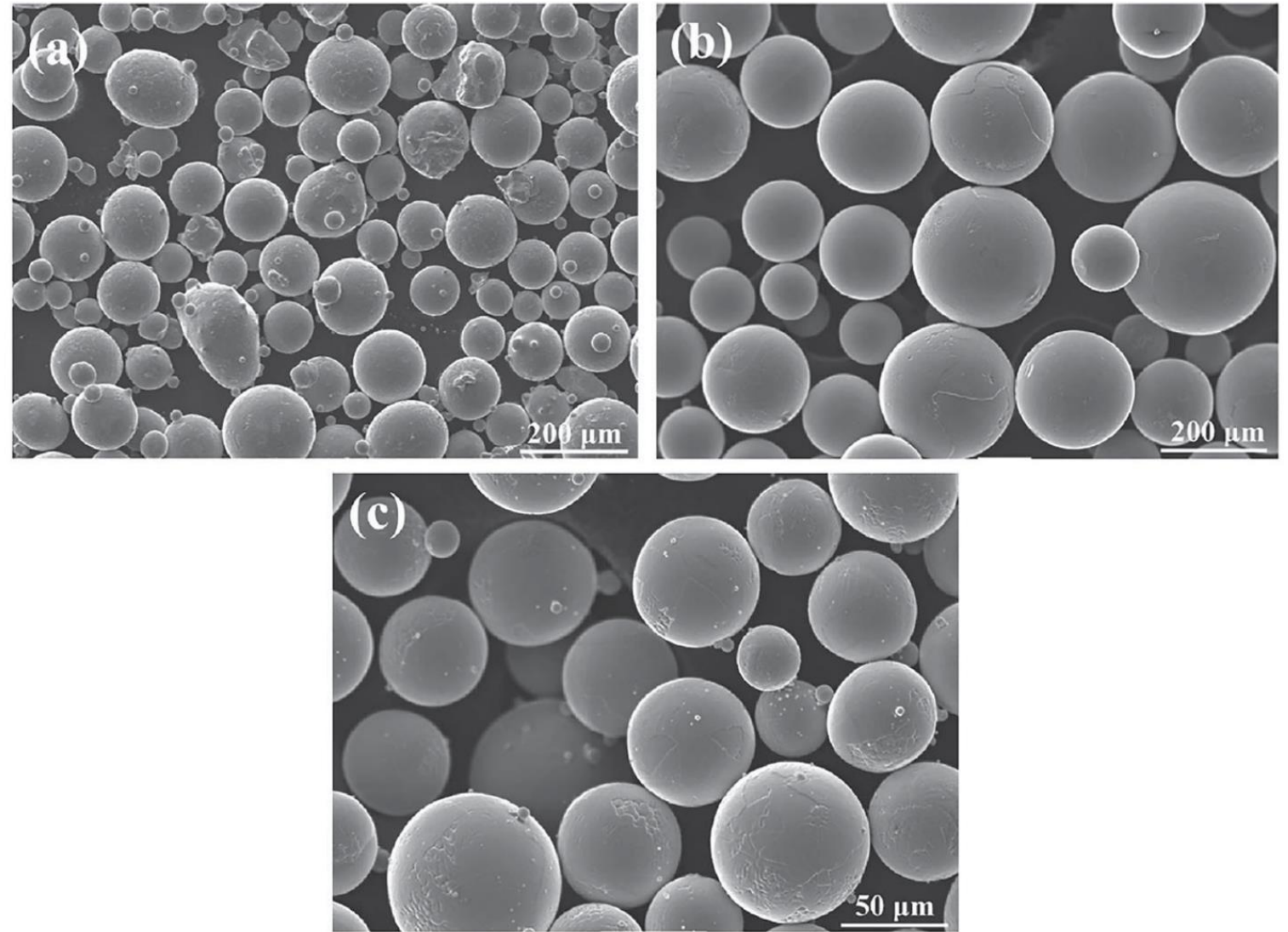
Fig. (a) Schematic plasma atomization process, and (b) plasma rotating electrode process



Source: Popov et al. 2021 [<https://doi.org/10.3390/ma14040909>]

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Fig. SEM micrographs showing morphology of the titanium alloy powders produced by: (a) gas atomisation, (b) plasma rotating electrode process, and (c) plasma atomisation



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Table 1.2: A summary of powder characteristics resulted from various production methods.

Production method	Size distribution (μm)	Benefits	Drawbacks	Suitable alloys
Gas atomisation	10 – 300	Good chemistry control Spherical powders Wide particle size distribution Wide range of alloys Suitable for reactive alloys Ingot or bar feedstock form	Satellites Wide particle size range	Ni alloys Steels Ti alloys Al alloys
Water atomisation	10 – 500	High throughput Ingot feedstock Wide particle size distribution	Irregular powder morphology Satellites	Non-reactive alloys
Centrifugal atomisation	10 – 600	Narrow particle size range	Difficult to produce fine powders	Steels
Plasma atomisation	10 – 300	Extremely spherical powders High flowability High purity powders	Wire feedstock high cost	Ti alloys Refractory alloys
PREP	50 – 350	Extremely spherical powders High purity powders	High energy consumption High cost	Ti alloys