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Powder Feeder for Advanced Manufacturing

AMF

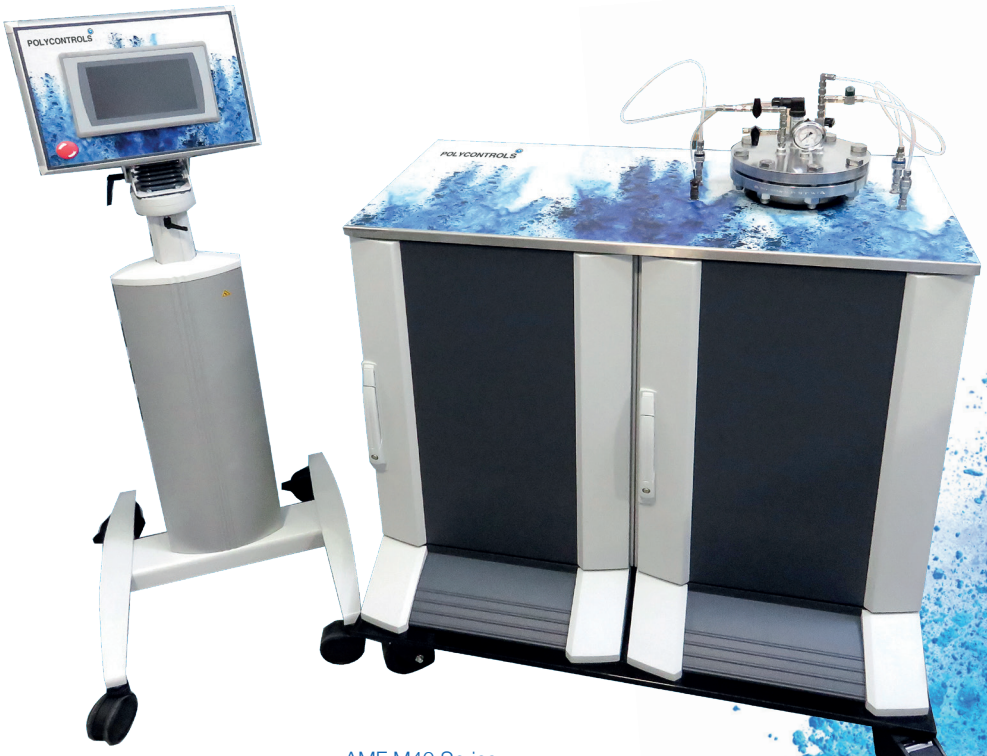
M40 Series

SUSPENSION FEEDER

Advantages

Specially designed to feed liquids in Thermal Spray applications, the M40 suspension feeder makes it possible to spray suspensions with very fine particles (from 0.001 to 25µm) to produce functional coatings with specific targeted microstructures. Designed without the need for a conventional pump, the M40 feeder opens the door to industrial applications requiring:

- Uniform feed of solids content up to 50 wt.% and viscosity up to 2000 cP.
- Continuous operation and real time density feedback to confirm uniformity of the feed stock.
- No clogging, tubing abrasion and fluctuation of the feed rate.
- Suitable for plasma and HVOF operation.



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Other advantages are:

- Feeds liquids with an accuracy of +/- 0.5% of rate, with density feedback to confirm uniformity of the particle content during deposition.
- Hazardous classification design enables M40 to be used with flammable solvents and liquid precursors as plain water-based solutions without concerns with E&HS.
- Standard reservoir capacity of 4.0 l suitable for medium spray runs; Configuration for continuous spray offer as an option.
- Magnetic stirrer built-in in the reservoir keeps the suspension agitated to avoid sedimentation.

Technical Specifications

Wide range of possibilities:

- M40 feeder pressurizes the slurry reservoir forcing the suspension or solution through a Coriolis meter for accurate measurement into the plasma or HVOF guns.
- Feeds suspensions up to 50 wt.%, solid concentrations.
- Configurable for both low and high feed rates.
- Uses magnetic stirring to maintain the suspension agitated at all times during the process.

Operation and Maintenance:

- Easy to clean: No clogging - All internal surfaces are stainless steel to prevent powder/ material accumulation.
- Easy to refill.
- Easy to operate & maintain.
- Built per North American standards, designed to be maintained in-house.
- Includes convivial human-machine interface for easy operation, control and data logging during production.

Industrial Characteristics:

- Meets North American Regulations (ASME, CRN, NFPA & UL); Hazardous classification and EH&S (Environmental Health & Safety) requirements.
- Designed to fit with third party equipment: Transparent integration with most commercially available Thermal Spray Plasma HVOF guns.

Technical Data

- Nominal suspension capacity: 4.0 l
- Feed rate range: Mass flow rate: 0.1 - 10 kg/h range
- Maximum allowable working pressure: 185 psig
- Meets North American pressure-vessel regulations (ASME & CRN), NFPA Standards & Hazardous classification
- Safety equipment according to EN 60204-1 (Category 1) Standard
- ASME Standards compliant (Section VIII, Div. 1 & ASME B31.3)
- UL Electrical Approval for Canada & USA

Examples of material fed

Powder	Solvent	Supplier	Solid Concentration	Particle size (D_{50})
YSZ	Ethanol	Homemade	20 - 25 wt.%	<0.1 µm
YSZ	Ethanol	Metco	25 wt.%	0.3 – 1.0 µm
YSZ	Ethanol	Innovnano	25 wt.%	0.4 – 0.5 µm
YSZ	Ethanol	Mettech	20 wt.%	NA
YSZ	Ethanol	Homemade	50 wt.%	<5 µm

Example of coating microstructures produced with M40 Suspension Feeder

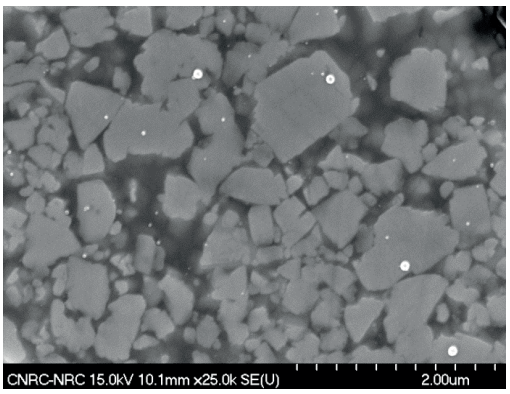

Figure 1 - YSZ powder

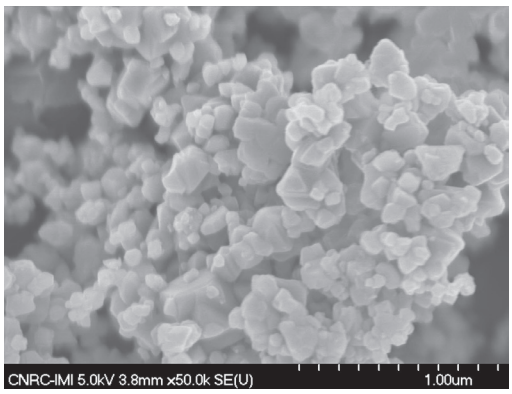

Figure 2 – WC-Co powder

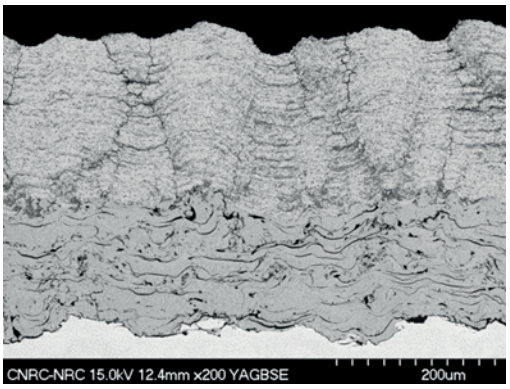

Figure 3 – Vertically cracked structure

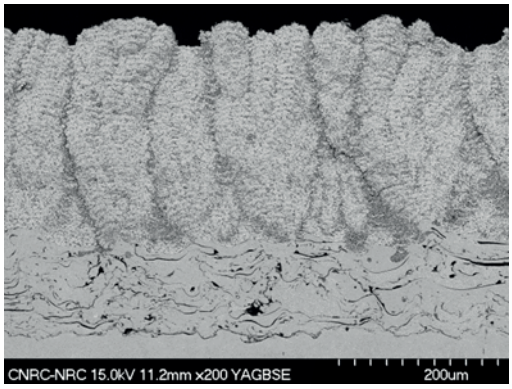

Figure 4 – Columnar structure

Commercial applications

Initially designed for the development of an alternative to costly and time consuming EB-PVD coatings for the production of thermal barriers (TBC), the M40 dispenser opens the door to novel suspension plasma spray applications requiring the continuous feeding of fine particles or the use of dense or viscous suspension.

The M40 opens possibilities to reduce the production time and overall costs of Thermal Barrier (TBC) manufacturing processes in areas such as aerospace, automotive and electrolyte coatings for solid oxide fuel cells (SOFC).

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