

Twin-screw extrusion

Thermo Scientific Energy 11 Parallel Twin-Screw Extruder

Enabling a continuous and thorough mixing, the Thermo Scientific™ Energy 11 Twin-Screw Extruder helps to overcome challenges in battery processing

Flexible setup

The Energy 11 Twin-Screw Extruder can be set up for a wide range of applications encountered in current battery R&D. The fully ported, horizontally split barrel allows for flexible feeding of solid and liquid ingredients. Interchangeable die designs adapt to a range of materials from dry granules, polymeric solid-state electrolytes, and electrode films to wet slurries. Eight precisely controlled temperature zones along the barrel ensure flexibility in processing.

We offer liquid and solid feeding options appropriate for the most demanding raw materials, while the segmented screw design provides the ability to adapt to disparate compounding or mixing profiles. The throughput ranges from 50 g/h to 5 kg/h of final product. With the detachable control panel, the extruder can be operated inside a fume hood or glovebox when necessary.

Specifically for the requirements in battery application, all product contact parts are made from CPM® steel, thus reducing the risk of metal abrasion in the final product. The whole assembly of the feed port, barrel, screw, and die can be detached with just one tri-clamp connection. This easy disassembly allows for fast cleaning and greatly reduces the chances of cross-contamination.

Application versatility

A variety of optional accessories and application packages are available that enable the Energy 11 Twin-Screw Extruder to be used for processes as diverse as the mixing of electrode materials with solvents, binders, and additives, or for the dry granulation of cathode materials to produce solvent-free cathodes. Research on solid state separator films or solvent-reduced electrode films can be carried out with the attachment of a slit die.

Safeguards against cross-contamination

The product contact parts are easily removed for cleaning. Replacement barrels and screws are available as individual options—ideal when dealing with numerous formulations and the risk of cross-contamination. This can save significant valuable time both for setting up experiments and cleaning.

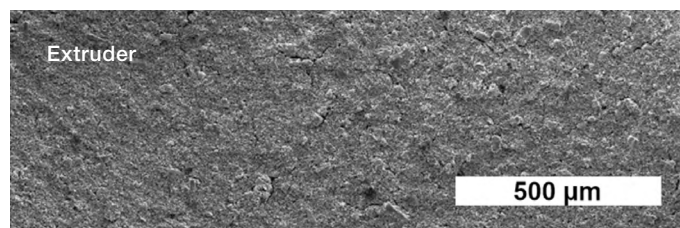
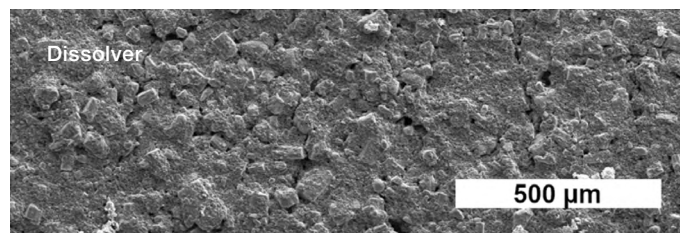


Overcoming battery challenges

The mixing of cathode active material with NMP (N-Methyl-2-pyrrolidone) solvent can be carried out in an extruder, resulting in a much more homogenous slurry compared to slurries mixed in conventional centrifugal mixers or dissolvers. The adaptable screw design allows a dispersive and distributive mixing process that results in a fine distribution of all ingredients. The whole process is continuous, thus eliminating batch to batch variations and delivering superior slurry quality.

Due to its high shear-force capability, the Energy 11 Twin-Screw Extruder can significantly reduce solvent during mixing—from typically 45 % down to 15 %. When scaling to a manufacturing process, this not only saves costs on solvents but also provides potential for big savings during the subsequent drying process, as the drying process will require proportionally less energy.

Going one step further in solvent reduction, the Energy 11 Extruder can be used for the dry processing of cathode materials for completely solvent-free products. With the available feeding and downstream accessories, a complete workflow can be realized.



Applications

- Granulation
- Separator film extrusion
- Electrode slurry mixing
- Solvent reduced mixing
- Dry electrode processing

Key benefits

- Real bench-top design with detachable control panel for flexible operation
- Completely exchangeable product contact parts made from high performance CPM steel—minimal abrasion and easy cleaning
- Barrel and screws available in other steel grades to cope with different materials
- Wide range of feeders with integrated controls in extruder control panel
- Segmented screw design and die variation for wide range of R&D applications
- Directly scalable to our larger extruders due to similar geometry

Technical data

Barrel diameter	11 mm
Barrel length	40 L/D
Barrel material	CPM 10V
Screw material	CPM 9V
Screw speed	10 to 1000 rpm
Temperature range	15 to 280 °C (8 individual zones)
Maximum torque	6 Nm / shaft
Maximum pressure	100 bar
Dimensions (L x W x H)	890 x 490 x 425 mm
Weight	70 kg
Power supply	230 V, 16 A, 50/60 Hz

Learn more at thermofisher.com/Energy11

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