

# MeltPrep

lets **you**  
**focus**  
on research



## VACUUM COMPRESSION MOLDING

Rapid and lossless prototyping of  
hot-melt extruded formulations

**f** **@** **in**  
meltprep.com



## What is VCM?

More than three letters.

VCM (Vacuum Compression Molding) is a process that transforms thermoplastic materials in homogeneous specimens without altering the source materials' characteristics due to degradation.

## What's inside?

Questions and answers.

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## Who are we?

Passionate preparers.

MeltPrep is an innovative laboratory equipment producer which has developed the first tailor-made process, specialized in sample preparation of thermoplastic materials. Our technology is a patented vacuum compression molding (VCM) process. VCM enables lossless and rapid production of solid samples by performing fusion under vacuum - starting from powder to the final sample.

The samples mimic hot-melt extruded (HME) formulations. The source materials' characteristics are not altered as minimum shear and heat load are applied. This enables accurate material characterization of samples produced by VCM, which also improves engineering and simulation results.



Founder, Dr. Daniel Treffer



## How does it work?

In three steps.

### Step 1: Vacuum Compaction

The desired amount of materials is filled into the VCM Tool. Vacuum is applied, compacting the powder as well as preventing bubbles.



Pellets or powder etc.

### Step 2: Melting

Rapid melting is achieved by heating the VCM Tool on a preheated hot plate. Particles fuse together to create a homogenous melt.



### Step 3: Cooling

Rapid cooling of the VCM Tool is obtained by convection and conduction on a separate cooling unit solidifying the sample.



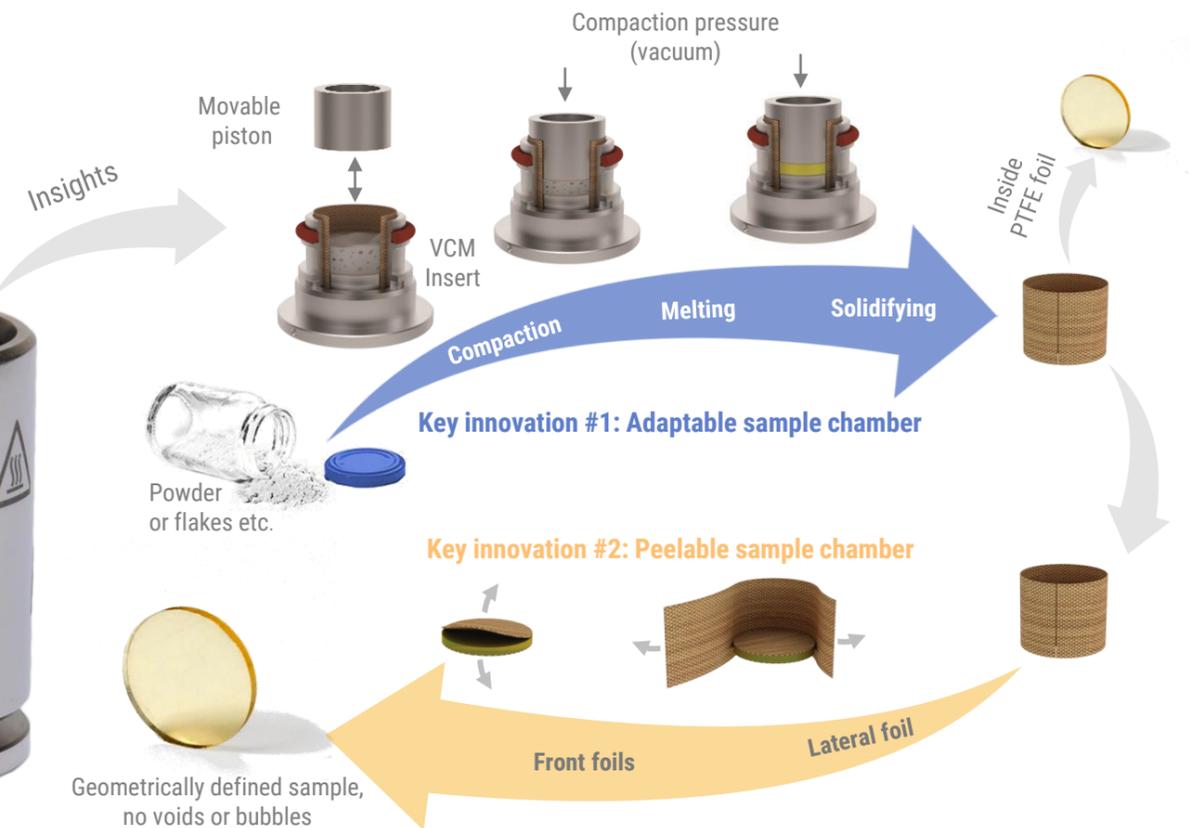
VCM Tool



## What are the innovations?

Simplicity at its best.

The VCM sample chamber is fully PTFE-lined and yet adaptable in volume. Thanks to the arrangement of the foils two key innovations are guaranteed. #1 **adaptable sample chamber**: It follows the natural material behavior during sample preparation. Density changes during compaction, melting and solidifying are compensated and defined sample geometries are obtained.



#2 **peelable sample chamber**: The separation foils are simply peeled off after the preparation process. No tedious cleaning is required. The chamber has no dead zones enabling lossless sample preparation. After the insertion of new foils the equipment is ready for the next preparation cycle. The foils can be reused multiple times making the process even more cost efficient.

Perfect samples

## What are the benefits?

### Shortcuts.

The key innovations change the rules. New possibilities simplify daily lab routines and open up new doors in development. Improved sample quality may reveal new insights into material characteristics. The shortcuts allow you to concentrate on more important tasks.

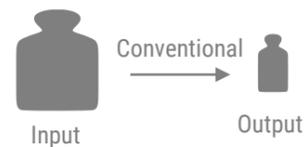
#### Homogeneous with defined geometry

Air inclusions are prevented using vacuum during the entire sample preparation process. Even micronized powders melt homogeneously to form solid specimens with defined geometries.



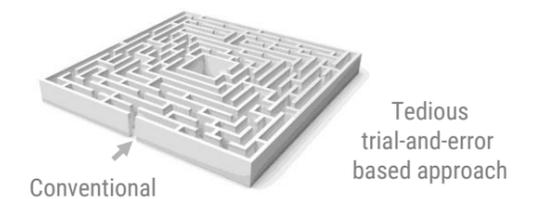
#### Lossless sample preparation

The VCM Tool is the first device to enable lossless sample preparation. Thanks to the thoughtful design of the sample chamber there are no dead zones.



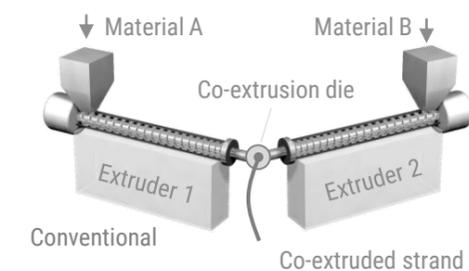
#### Rapid & straightforward process

The process is robust and easy to operate. The temperature is the key process parameter. A sample is usually produced in less than 10 minutes without tedious process development.



#### Multilayered structures prototyping

The VCM process can be used to combine several VCM samples to one merged multilayer sample easily. Multilayer structures result in different functional benefits (e.g. diffusion barrier).



#### Minimal cleaning effort

The separation foils form the sample chamber. Replacing the foils saves you valuable development time as cleaning is reduced to a minimum.



## VCM Essentials

Simplicity and precision.

The VCM Essentials provide a tailor-made environment for the VCM Tools. Highest reproducibility and safe operation are obtained. Thanks to the easy-to-use VCM Essentials samples with unmatched quality can be produced within minutes, without the need for tedious process development or cleaning.

**Heating Unit**

300°C  
25°C

A heat buffer is mounted on a state-of-the-art hot plate on the market meeting the highest quality and safety standards. The heat buffer establishes constant temperature levels and its integrated vacuum clamping system ensures reproducible heat transfer during melting.

**Vacuum Unit**

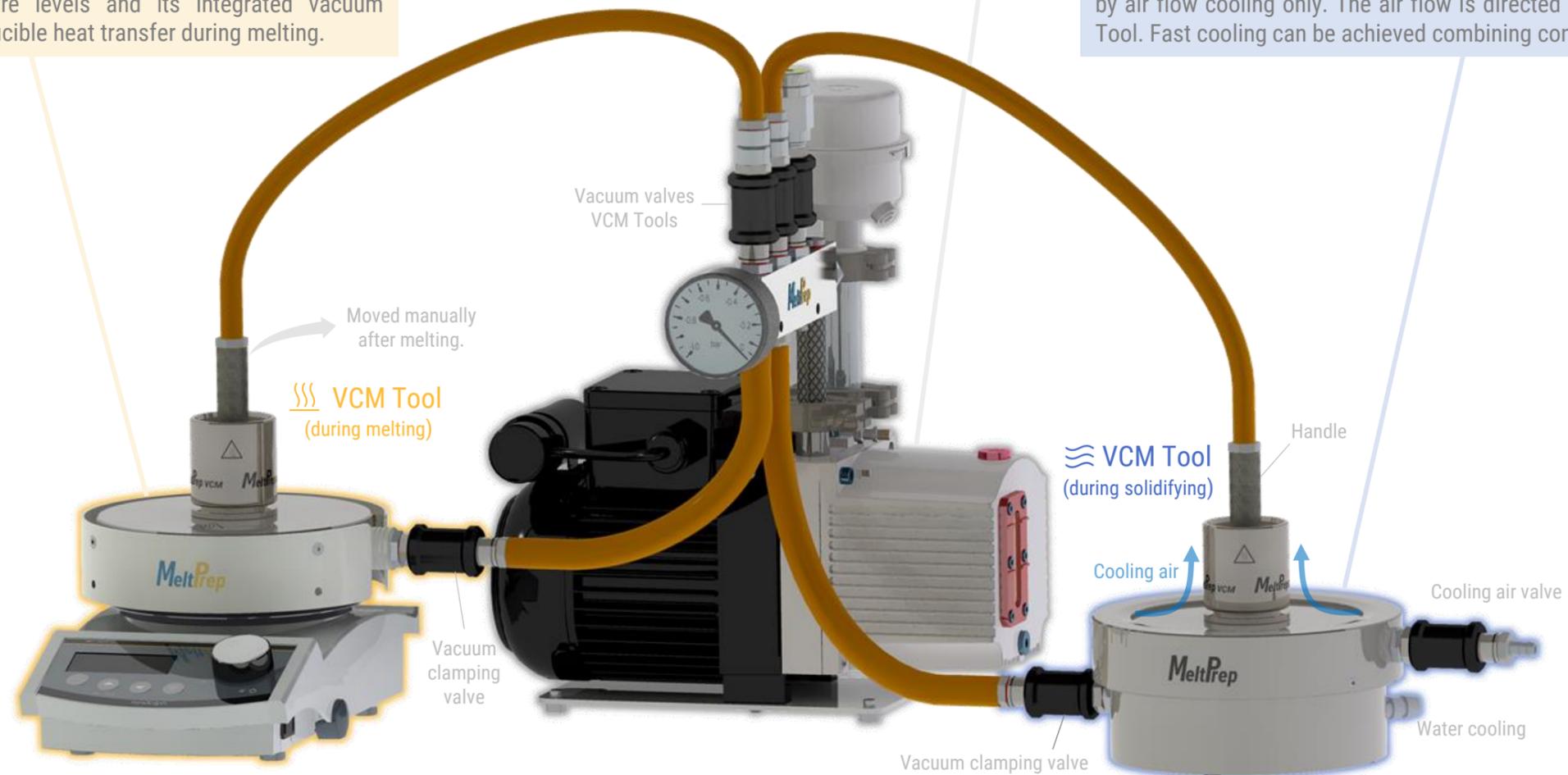
0,1 mbar 1 atm

High vacuum levels as well as arbitrary levels can be set thanks to an integrated controller. The user-friendly distribution system with individual switchable vacuum circuits supplies up to two VCM Tools and the vacuum clamping ports.

**Cooling Unit**

SLOW & FAST

Water cooling of the buffer as well as the vacuum clamping system of the VCM Tool ensure reproducible cooling conditions. Slow cooling is achieved by air flow cooling only. The air flow is directed circularly towards the VCM Tool. Fast cooling can be achieved combining contact and air cooling.



## VCM Tools

The heart of the technology.

The VCM Tool family serves as a modular solution to face the wide-ranging requirements of sample dimensions. The Disc Tool is equipped with a 25 mm Disc Insert and the Bar Tool with a 10x40 mm Bar Insert. They are designed for thermoplastic materials at viscosities above 100 Pas.

## VCM Inserts

You decide.

Different material characterizations require various sample geometries and dimensions. The cross section of the sample is defined by the shape of the VCM Insert. Five disc and one bar dimensions cover a broad range of the standard tests. No worries if you cannot find your dimension, we provide also custom solutions.

### VCM Disc Tool

Cylindrical samples.



### VCM Bar Tool

Elongated samples.



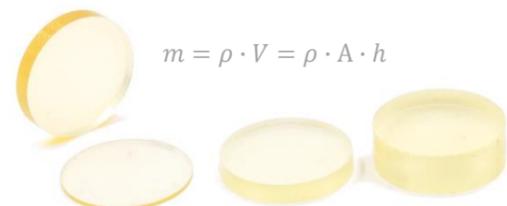
### VCM Disc Insert

5 Diameters.

- Piston
- VCM Chamber
- Separation foils and sample
- Base plate

### VCM Bar Insert

1 Rectangle.

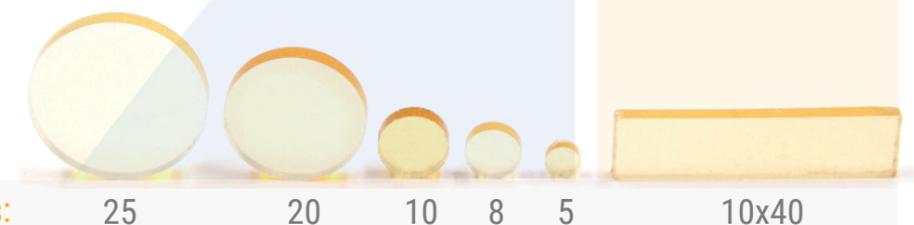


$$m = \rho \cdot V = \rho \cdot A \cdot h$$

### Unlimited Heights

The sample height can be easily adjusted between 0.1 and 10 mm by changing the filling weight.

Available Dimensions:



## VCM Accessories

Simplifying things.

The VCM Technology is designed to make your daily lab routines as smooth as possible. The accessories include separation foils which are multiple times reusable consumables and a modern temperature logger for accurate temperature acquisitions.

### Separation Foil Packs

Saves you weeks of cleaning.

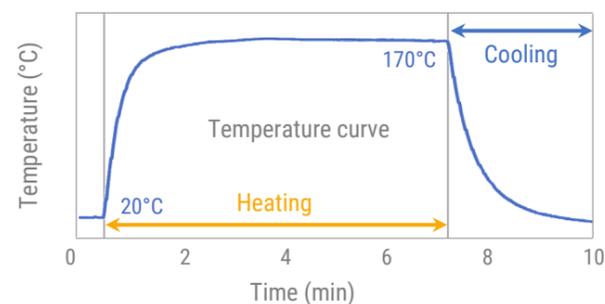
One pack consists of 100 sets of separation foils. Thanks to the precise cut of the foils, the best possible results are guaranteed.



### Temperature Logger

A tireless clerk.

Temperature is the most important parameter of the VCM process. Data can be gathered and evaluated easily by using a smartphone or PC via Bluetooth.



## VCM Lids

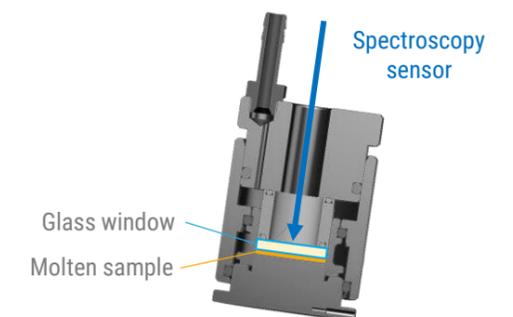
Flexibility enhancers.

In laboratories tasks are diverse. Additional lids for the VCM Disc Tools allow you to accomplish even more tasks. The special designs allow either the integration of spectroscopic tools or the reduction of compaction pressure enabling preparation using materials with lower viscosities.

### Spectroscopy Lid for VCM Disc Tool

Provides insights.

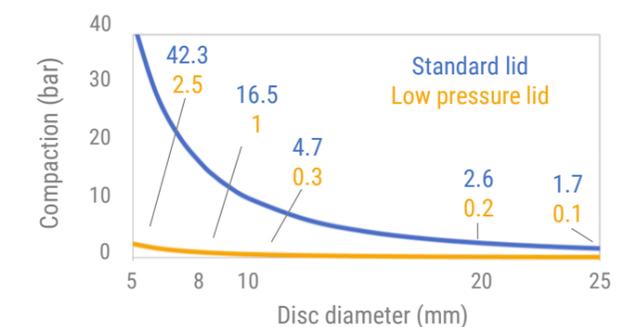
The VCM Tool is equipped with a glass window above the sample. A spectroscopy sensor can be installed. Changes during melting and solidification as well as degradation can be investigated.



### Low Pressure Lid for VCM Disc Tool

For low viscous materials.

The low pressure lid reduces compaction pressure and increases the applicability of the VCM Tool for processing lower viscous samples. Preparing low viscous samples using the standard lid may cause unwanted leaking.



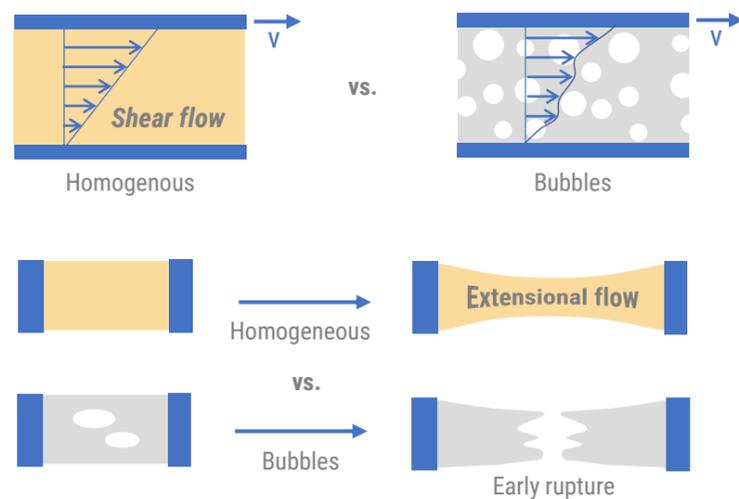
## What can it be used for?

Preparing flawless samples.

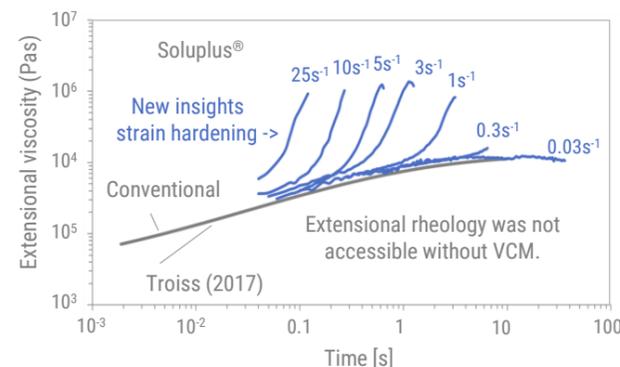
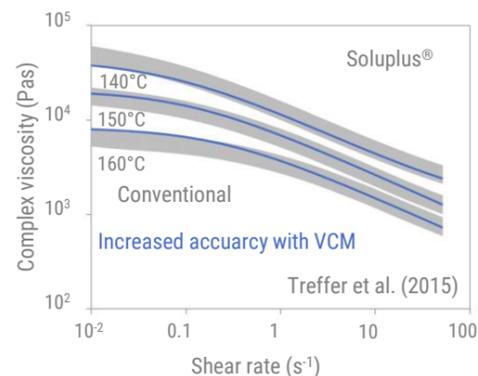
Most textbooks on different measurement techniques describe the uniformity with defined geometries as the key to determining accurate material properties. The VCM technology was originally developed for preparing samples for rheological measurements.

### Rheology (Discs 8-25 mm & Bars 10x40 mm)

When studying flow behavior, samples are deformed within defined measuring geometries and characteristic material properties are derived. When bubbles are present, the flow field is distorted and the measurement falsified.



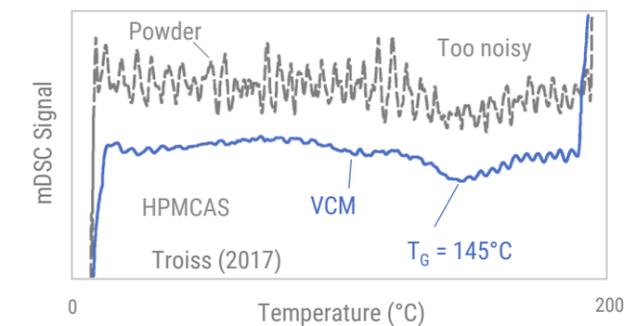
Extensional rheology requires homogeneous bars to obtain results. No sample preparation starting from powders existed so far. VCM opens the opportunity for the first time. New insights help to understand material and processing behaviors.



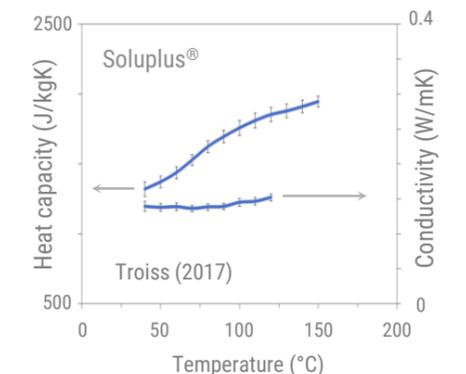
Our customers use the flawless VCM samples for various measurement methods such as DSC, hardness, notch impact strength, heat capacity, solubility, DMTA, microscopy etc. Below is a short excerpt of one of the most frequently requested measurement methods.

### DSC Measurements (Discs 5 mm)

Samples are placed in a crucible and subjected to a controlled heat transfer cycle. Particle boundaries hinder heat transfer. Homogeneous VCM samples ensure uniform heat transfer and will lead to more significant results.



Moreover, thermal conductivity and heat capacity can be derived via a mathematical model from modulated DSC measurements on two samples with different thicknesses. Both values can be derived from sample quantities lower than 100 mg of material.



## What about prototyping?

Nothing easier than that.

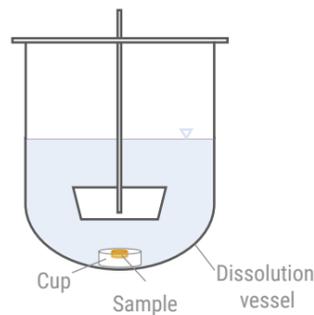
Pilot plants and six-digit Euro investments were required for prototyping of pharmaceutical dosage forms with melt-processed carriers in the past. Now, the VCM technology enables rapid prototyping at a fraction of costs and time required for traditional prototyping methods.

### Dissolution (Discs 5-25 mm)

MeltPrep samples can be used for intrinsic dissolution testing giving valuable insights into formulations characteristics. The samples have defined geometries and release the drug via a defined surface, thus specific drug release properties can be derived from testing. Optional cups can be used to enable unilateral testing.

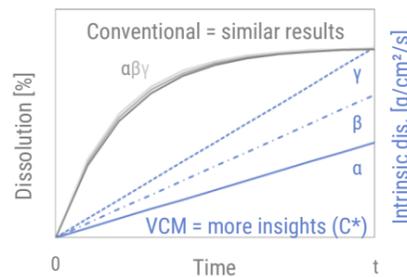
$$\dot{N} = D \cdot \frac{A}{h} \cdot (C^* - C)$$

Noyes-Whitney equation

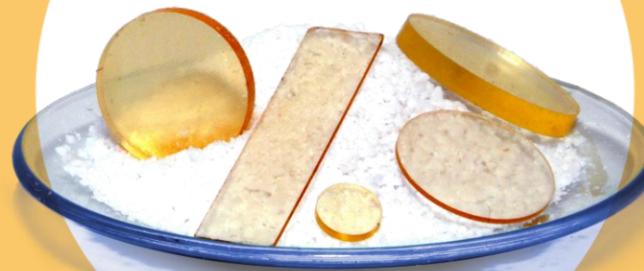


$$\dot{n} = \frac{\dot{N}}{A} = \frac{D}{h} \cdot (C^* - C)$$

Intrinsic dissolution rate



VCM is the fastest way from powder to sample



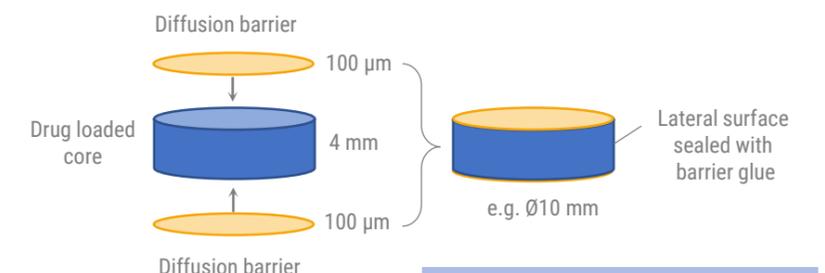
## Is that all?

Not even close.

The VCM Technology enables the production of multilayer samples. Layers of different materials are prepared one by one. Subsequently, the layers are stacked in the desired order and loaded into the VCM Tool. By performing an additional VCM cycle they are fused to one solid multilayer sample.

### Diffusion Studies (Discs 8-25 mm)

Multilayer samples are requested in galenics to study drug diffusion and release. They are also used for controlled release drugs. A well-known example is the intra-vaginal birth control ring (IVR) from Merck (NuvaRing™).

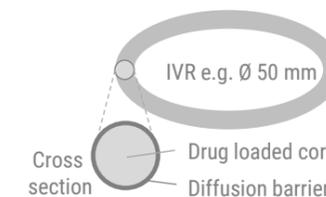


VCM preparation < 1 day

vs.

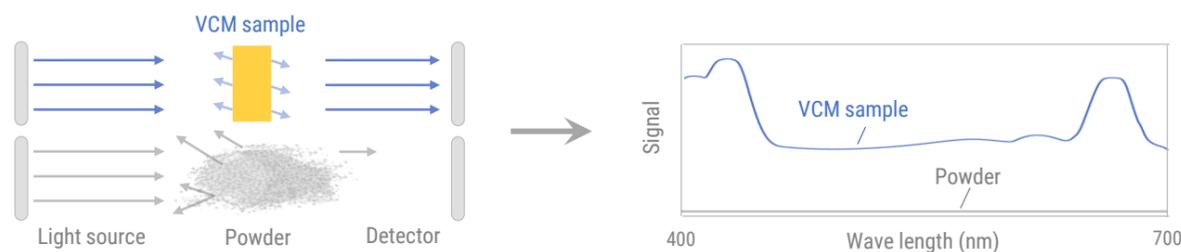
Conventional co-extrusion > weeks

Similar results at a fraction of the cost and time



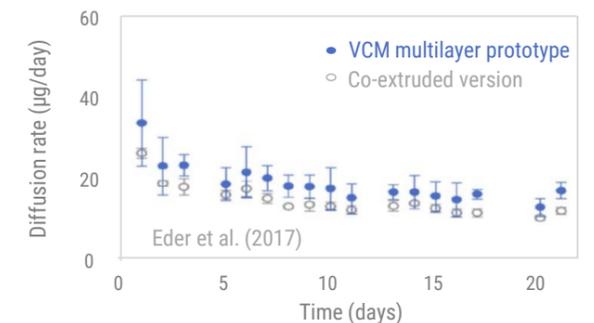
### Spectroscopy (Discs 25 mm)

MeltPrep has developed dedicated easy-to-use offline solutions for combining the VCM Tools with common process sensors to analyze molten samples offline. The results can be used for designing the probe position for inline implementation.



Publication  
Eder et al. (2017)

Standard dissolution testing and surface corrections lead to similar results. In many cases there is no need for executing pilot scale experiments.



Only a limited selection of examples for prototyping and sample preparation is included in this brochure. For more information please visit our webpage and check out our PrepNotes on the applications page.

## Who uses it?

Innovators.

Our VCM technology is designed for highly challenging pharmaceutical requirements. The benefits of our system have already attracted the attention of different industries. Our clients gain advantage in their daily routines and accomplish more of their important tasks. See for yourself what our customers say.



Pharma

Food

Plastics

# MeltPrep

## What do they say?

Real and honest.

### Axel Zeitler

Professor, Cambridge University, UK

"Having the MeltPrep system in our lab has completely transformed our preparation of thin films of polymer materials as well as amorphous drug materials for analysis using terahertz time-domain spectroscopy. Previously we had to prepare the films manually on a quartz substrate and assemble the sample on a hot plate. This was not only inconvenient but resulted in poor reproducibility and homogeneity of our samples. Using the MeltPrep we now make samples not only in a fraction of time but with excellent quality each time."



### Korbinian Löbmann

Ass. Prof. Pharmaceutical Design & Drug Delivery, University of Copenhagen

"The MeltPrep vacuum molding device is an excellent tool for the production of homogeneous and geometrically well-defined specimens and offers a high reproducibility. We use it for shaping various materials, ranging from polymer-based formulations to pure small molecular weight materials in the amorphous form, and we are very satisfied with the convenient, user-friendly and simple sample preparation. Furthermore, Daniel gives excellent customer support and offers solutions for every potential application."

### Johannes G. Khinast

Scientific Director, RCPE GmbH, Austria

I am very happy about the success of MeltPrep, which was developed at my Institute in the context of Daniel's PhD. Now, the MeltPrep VCM equipment is a valuable element for laboratory routines at my Institute and the Research Center for Pharmaceutical Engineering ([www.rcpe.at](http://www.rcpe.at)) as it reduces our sample preparation efforts significantly. The increased sample quality leads to higher accuracy of measured material data, which is the basis for precise process development, scale-up and optimization. In addition, it allows rapid prototyping of novel dosage forms (e.g., multilayer structures) without wide-ranging process developments. I am thus looking forward to continuing the excellent cooperation between RCPE and MeltPrep.



### Montgomery Shaw

Emeritus Professor, University of Connecticut, USA

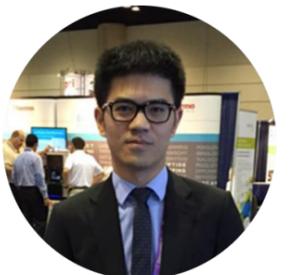
I met the founder, Daniel, at a SPE Conference in Graz. His talk reminded me of the paper „Getting the most out of a polymer via vacuum compression molding“ from the 70s, which went along similar lines. However, Daniel from MeltPrep has designed his VCM tools to make VCM simple and reliable.



### Henry Lu

Laboratory Specialist at Shin-Etsu, USA

"MeltPrep is very helpful for polymer rheology study. It requires very limited amount of material, and the samples obtained were uniform and consistent for the measurement. The sample preparation is also easy and can be done within short period of time. In addition, MeltPrep was able to produce samples with different sizes/shapes, which makes it suitable for different kinds of rheological tests."



# Got your attention?

[www.meltprep.com](http://www.meltprep.com)

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Partnering with

