

MKE Hardware Platform

- 4차산업혁명 대응을 위한 실험데이터 통합 관리시스템 적용 -
(신제품개발, 생산성향상, 원가절감, 납기단축을 위한 실험장비 솔루션)

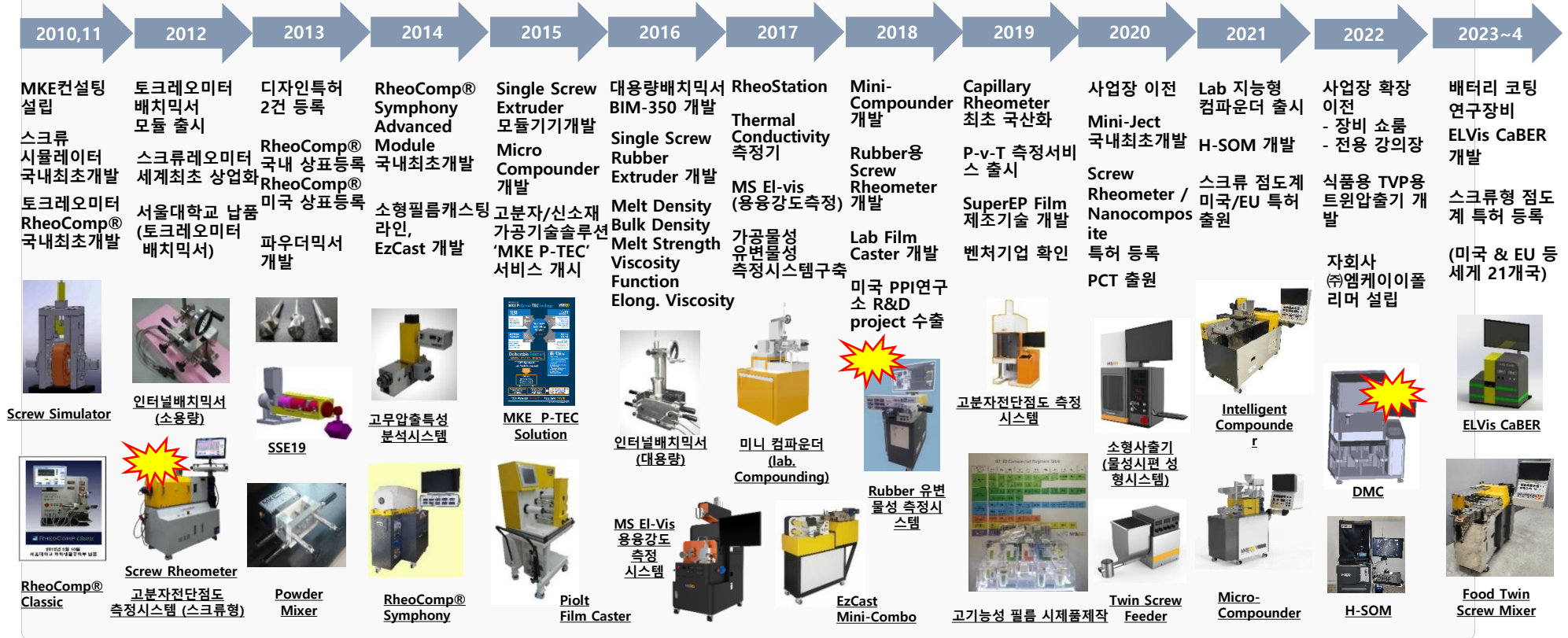
2024



No	MKE 주요 제품 군	모델명	일반명칭 및 참고사항	MKE
1	토크레오미터 시스템	RheoComp® System	브라벤더 동일 시스템 (본체 + 모듈)	
		Harmony/Concerto/Nano	토크레오미터 구동본체 (<i>i-RheoComp</i> ® O/S)	
		BIM-150	배치믹서 모듈 ; 최종 시료량 40~50 g	
		BIM-350	배치믹서 모듈 ; 최종 시료량 200~230 g	
		SSE19	플라스틱용 단축압출기 모듈 ; Ø 19mm (단독형 가능)	
		SSRE19	Rubber용 단축압출기 모듈 (단독형 가능)	
2	필름다이	T-die, T-die(S) series	필름/시트 용 T-die (adjustable)	
3	필름 캐스팅라인	EzCast System	Computer controlled Film Solution (랩, 파일롯 스케일)	
		EzCast Mini / Mini-Combo	랩스케일 필름 캐스팅 컴파운드 업체 Gel count film 제작용으로 활용 가능	
		EzCast V.1	파일롯 스케일 필름 캐스팅 (시간당 300g, roll width ~300mm, 냉각온도 120/140°C)	
		EzCast BF	파일롯 스케일 Blown Film용 (Spiral mandrel die ~ 50mm, Roll width ~300mm)	
4	마이크로 컴파운더	MKE Micro-Compounder	실험실용 소량 컴파운딩 솔루션 (초소량 배치 or 연속식) (소재 개발을 위한 소량 블렌딩.컴파운딩용 장비)	
5	스마트 컴파운더	Co-TSE25 (MC- / IC-)	소형 이축압출기(단독형) - <i>i-RheoComp</i> ® optional / 식품용 모델..	
6	시편 몰딩기	Mini-Ject	물성측정시편 몰딩기 (ISO/ASTM 표준 및 DMA용, lenz, color mold 등)	
7	스크류 레오미터	H-SOM	Hot-stage Scanning Optical Microscope (온도변화에 따른 고분자 성상변화 관찰용 현미경)	
8	용융강도 측정기	MS-ELVis	Capillary die 토출물의 용융강도 측정 ("G"사 RheoTens 유사제품, 재연성 우수)	
9	복합물성측정기	DMC (Capillary/Thermal K/PVT)	모세관 고분자 전단점도 / 열전도도 / PVT 복합측정장치	
10	핫스테이지 현미경	MKE Screw Rheometer	고분자 전단점도 측정 (스크류방식) Polymer Melt, Rubber, Slurry용 별도 모델	

MKE 연구장비 개발 연혁 (30여종 장비 100% 자체기술, 전 제품 최초 국산화)

시장 평가: "독일 성능의 국산 장비"



3종 연구장비 : 세계최초 상용화 / 국내, 미국, 유럽 등 21개국 특허 등록

개발 장비 및 R&D Project 수출 130만불 (미국 US Army 등)

MKE 토크레오미터 (*RheoComp[®] System, Basic*) (Command Station (Harmony) & Batch Internal Mixer)



MKE Torque Rheometer RheoComp[®] [Batch Mixer System]

Command Station

RheoComp[®] Harmony

Automatic control & Data Acquisition System

(Temp., Rpm, Torque)

Servo motor & driver

1100 * 1300 * 1800 (본체, 믹서, 모니터 포함)

내장형 컴퓨터, 포터블 키보드 사용

추가 컴퓨터데스크나 공간 필요 없음

EuroMap Compatible Modbus protocol

Batch Internal Mixer Module

BIM-150 with a Blade set

Sample vol. 45~50g

Blade type : Roller, Banbury, Cam, Sigma

(Upgraded Design, 2021)



i-RheoComp[®]



MKE 토크레오미터 (RheoComp[®] System, Advanced) (Command Station & Batch Internal Mixer w/ EzCarry)

MKE Torque Rheometer RheoComp[®] [Batch Mixer System]

Command Station

RheoComp[®] Concerto / Concerto-Nano

Automatic control & Data Acquisition System

(Temp., Rpm, Torque)

Servo motor & driver

1100 * 1300 * 1800 (본체)

내장형 컴퓨터, 포터블 키보드 사용

추가 컴퓨터데스크나 공간 필요 없음

EuroMap Compatible Modbus protocol

Batch Internal Mixer Module with Carrier

BIM-150 or BIM-350 with a Blade set

Sample vol. 45~50g / 200~250g

Blade type : Roller, Banbury, Cam, Sigma

(Upgraded Design, 2021)



MKE 토크레오미터 구동본체 (RheoComp[®] System) (Command Station)

MKE Torque Rheometer RheoComp[®]

Automatic control & Data Acquisition System
(Temp., Rpm, Torque)

Servo motor & driver

W1100 * D1300 * H1800

내장형 컴퓨터, 포터블키보드 사용,
추가 컴퓨터데스크나 공간 필요 없음

RheoComp[®] Harmony

RheoComp[®] Concerto

RheoComp[®] Concerto-Nano

(Module 확장성, 모터용량, Torque limit 등 차이)

(Upgraded Design, 2021)

EuroMap Compatible Modbus protocol



i-RheoComp[®]

[해당 Model]

Harmony Plus

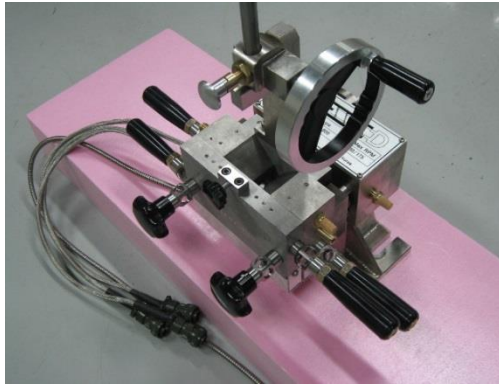
Concerto

Concerto-Nano

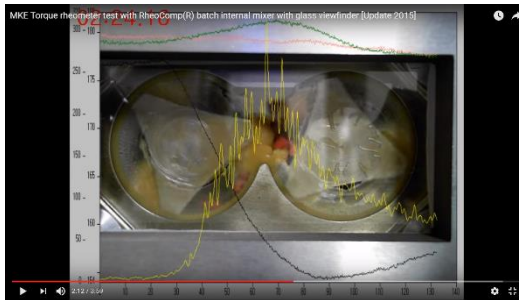


MKE

MKE 토크레오미터 배치믹서 (RheoComp® System) (Batch Internal Mixer Module)



BIM-150 (시료량 ~ 50 g)
소형배치믹서모듈
(대차 없이 본체에 장착가능)



[배치믹서 실험동영상 보러 가기](https://www.youtube.com/watch?v=A-AXLCA0-3c&t=8s)
<https://www.youtube.com/watch?v=A-AXLCA0-3c&t=8s>



BIM-350 (시료량 ~ 200g)
(대차 형태로 본체 장착)

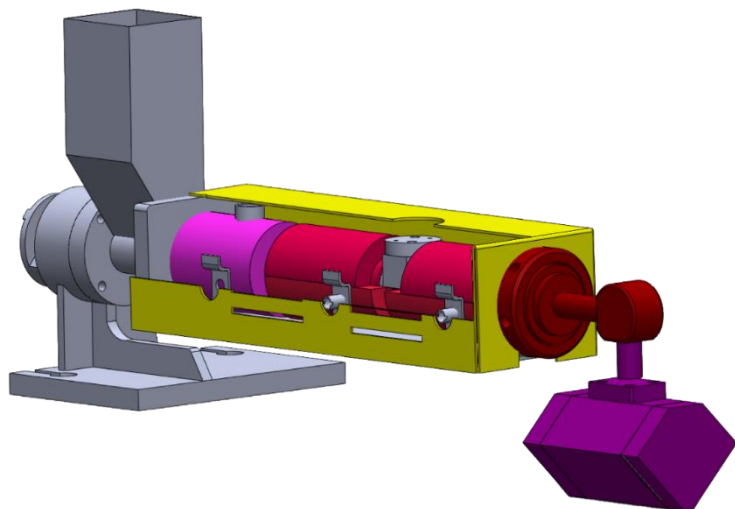


MKE 토크레오미터 실험실용 압출기 모듈 (RheoComp® System)

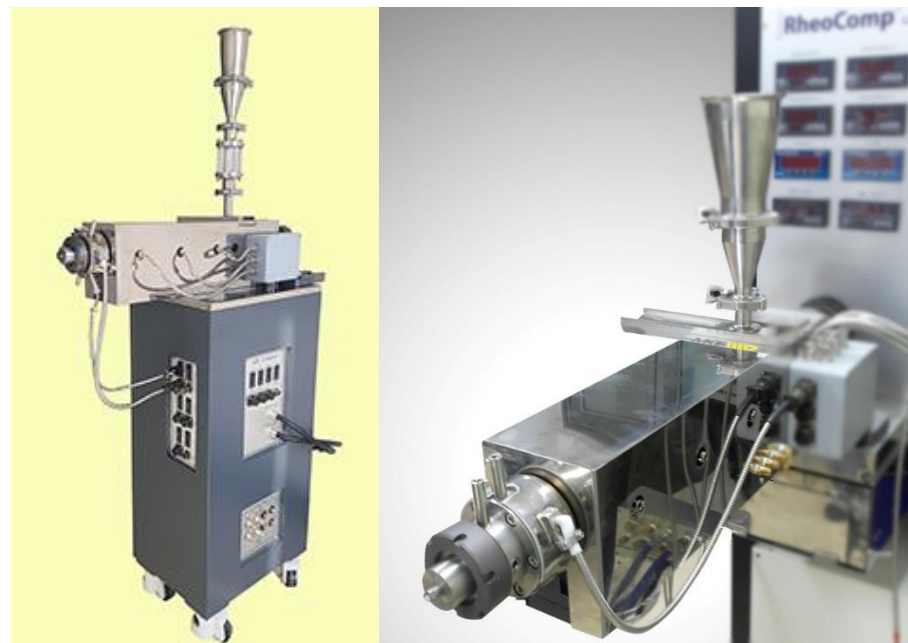
(Single Screw Extruder Module)



i-RheoComp®



SSE19 + Deflection Head + T-die



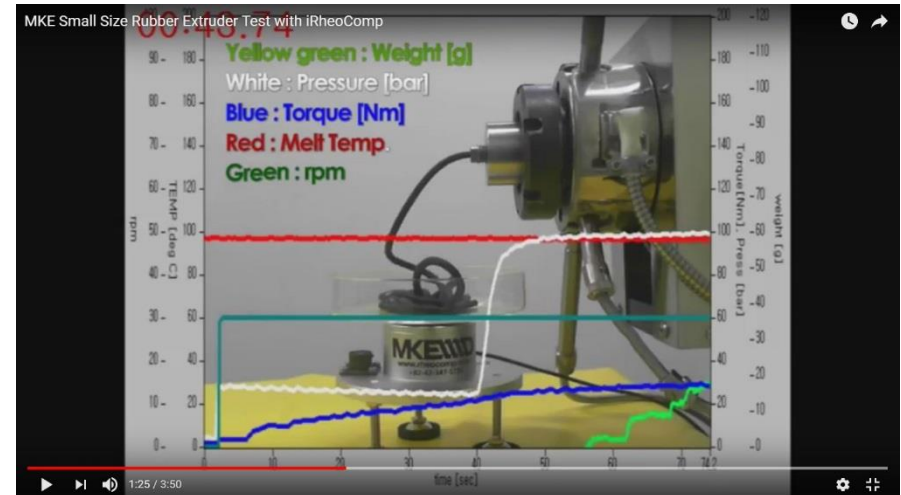
SSE19 + Strand die

MKE 토크레오미터 Rubber용 압출기 모듈 (RheoComp® System)

(Rubber Single Screw Extruder)



i-RheoComp®



SSRE19 Youtube 실험동영상

<https://www.youtube.com/watch?v=NS3JW7nfr9Q&t=4s>

(유튜브에서 'MKE Rubber'를 검색하세요)

SSRE19

Rubber용 단축압출기 모듈, Option ; Rubber strip feeding motor

MKE

일체형 압출평가장비 (SSE19 System)

(MKE Lab. Extrusion System)



i-RheoComp®

Single Screw Extruder System

(자동컨트롤, 일체형시스템)

- 내장형 컴퓨터, 자동구동 o/s, 휴대용 키보드 사용,
- 추가컴퓨터데스크나 공간 필요 없음
- W840 * D850 * H1600
- 실험 프로토콜 입력 및 자동 실행
- 온도, 압력, rpm, 토크 등 데이터의 실시간 모니터링
- 자동 그래프 출력 기능
- 압출기 최고온도 350 °C
- Single Strand die 포함
- Barrel diameter 19mm, 25 L/D
- No vent extruder

(모든 제품의 외관 디자인은 사양에 따라 변동될 수 있음)



일체형 Rubber용 압출평가장비 (RPE-II)

(MKE Rubber Processing Evaluator-II)

Garvey extrusion test (ASTM D2233)

Extrusion capillary test (ASTM D5099)

Extrudate swell test (ASTM D2230)

RSR (Rubber Screw Rheometer)

Rubber용 스크류 방식 전단점도 측정장비

Shear Viscosity Function

Viscoelastic property

Reproducibility within $\pm 2\%$

Shear rate range

: 0.1~10 / 1~100 / 10~1000 [1/s]

- 절대값으로 이용하는 점도측정 데이터
- 생산 제품의 품질기준 적합성 평가
- 컴파운드의 분산성, 가공성 평가
- 전단 점도 측정을 통한 처방(recipe)별 비교
- Rubber/Elastomer/Plastics 원료의 특성 파악
- 첨가제의 가공성 영향 평가
- 쉬운 Carreau model fitting



MKE 필름 솔루션 (*EzCast System*) : 실험실용 필름성형시스템



(LAB-scale Film Casting Line)

EzCast Mini / Mini-Combo

Laboratory cast film manufacturing

Gel count film making (Compounding)

Film composition test

Roll width : ~150mm

Combo construction of

Extruder & Casting line (manual control)

Film extrusion teaching line (LDPE, HDPE)

MKE 필름 솔루션 (EzCast System) : 파일럿 필름성형시스템

(Pilot-scale Film Casting Line)

EzCast V.1

Pilot cast film manufacturing
Roll temperature : 110 / 150 deg C
Roll width : ~ 300mm
Computer control



EzCast V.1

BF Solution



EzCast V.1 유튜브 실험 동영상 링크 보러가기 (LDPE)
<https://www.youtube.com/watch?v=COHFLQpxju4>
(유튜브에서 'Pilot Film Casting line'을 검색하세요)

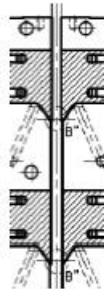
MKE 특수필름 (Specialty Film) (Specialty Film : PLA, EVOH, PPS, TPU & more)

Advanced Packaging Film
Performance Film
Technical Film



MKE Film R&D History

- Mono-layer (단층필름)
16개 양산라인 T-다이 설계 적용
(1992~2007)
- Multi-layer (다층필름)
국내 최초 5층 feedblock 설계
(2003)
- Micro-layer (N층필름)
64 layer duplication technology
(2016)
- **이제는 SuperEP film 입니다!!!**



기능성 필름의 새로운 역사를 써 내려갑니다.



G7-82 Commercial Polymers Table

Industrial Compostable Plastics	PLA Polylactic acid	TPS Thermoplastic Starch	PEC Polylactide Carbonate	PPC Polycarbonate	CA Cellulose Acetate	PES Poly Ethersulfonate	PBS Poly Butylene Succinate	PBAT Polybutylene adipate terephthalate	PVA Polyvinyl Alcohol	PCL Polycaprolactone	PHA Polyhydroxybutyrate	
Commodity Thermoplastics	ABS Acrylonitrile Butadiene Styrene copolymer	SAN Styrene acrylonitrile copolymer	ASA Acrylonitrile Styrene Acrylate copolymer	SB Styrene Butadiene copolymer	PS Polystyrene	LDPE Polyethylene low density	LLDPE Polyethylene linear low density	HDPE High Density Polyethylene	HMWPE Polyethylene ultra high molecular weight	EVA Ethylene Acetate	PP Polypropylene	
	PB Polybutene	PIB Polyisobutylene	PVC-P Polyvinyl chloride (soft plastic)	PVC-U Polyvinyl chloride (ultra-soft plastic)	CPE Chlorinated Polyethylene	PVDC Polyvinylidene chloride						
Engineering Thermoplastics	PA11 Polyamide 11	PA12 Polyamide 12	PA46 Polyamide 46	PA6 Polyamide 6	PA610 Polyamide 6/10	PA612 Polyamide 6/12	PA66 Polyamide 66	PBT Polybutylene Terephthalate	PET Polyethylene Terephthalate	PC Polycarbonate	PMMA Polymethyl methacrylate	
	POM (Amorphous) Polyoxymethylene	POM (Crystalline) Polyoxymethylene	POK Polyether Ether Ketone	mPPO,PPE Modified Polyoxymethylene Polyether Ether Ketone								
Super Engineering Thermoplastics	PPS Polyphenylenesulfide	PSU Polysulfone	PTFE Polytetrafluoroethylene	PVDF Polyvinylidene fluoride	FEP Fluoropolymer	ETFE Ethylene tetrafluoroethylene	PVF Polyvinylidene fluoride	PA6-3-T Polyamide 6/3 T	PA6/6T Polyamide 6/6 T	PEI Polyetherimide	PES Polyethersulfone	
	PEEK Polyetheretherketone	PEKEKK Polyetheretherketone etherketone	PFA Perfluoroalkoxy	(HBA/HNA)-LCP Liquid Crystalline Polyimide	LCP Liquid Crystalline Polyimide							
Thermoplastic Elastomers	TPO,TPV Thermoplastic Olefin	TPU Thermoplastic Polyurethane	TPC Thermoplastic Polyether Ether Ketone	TPA Thermoplastic Polyamide	TPS Thermoplastic Starch	POE Polyolefin Elastomer						
Elastomers & Rubbers	BR Butadiene rubber	CR Chloroprene rubber	EPDM Ethylene Propylene Diene Monomer	NR Natural rubber	Q Silicone rubber	SBR Styrene Butadiene Rubber	EPR Ethylene Propylene Rubber					
	EP Epoxy resin											

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100-0001-0001

100-0001-0



MKE의 영적 조력
MKE는 이 세계를 바꿀 영적 조력자
이것이 영적 조력자입니다.
그 영적 조력자 MKE를 지켜주세요.
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MKE 실험실용 마이크로컴파운더 (MKE Micro-Compounder : 초소량 펠렛 제조)



i-RheoComp®



실험동영상 링크 (유사모델 참고)

https://youtu.be/4Wy4o_cOu9o?feature=shared

MKE

Co-rotating Twin Screw Compounder
for 'smallest size circulating mixing'
Lab. Compounding Solution with Smart O/S
(4th Industrial Revolution Compatible System)

<Micro twin model with "kneading blocks">

MKE Micro-Compounder (circulating Batch type)

- Batch volume: 20 ~ 100cc or 40 ~ 200 cc
(2 가지 모델 중 선택, 소재 및 조건 별로 상이함)
- *circulation, kneading block* included => **incredible mixing**
- Throughput (continuous mode 가능)
- Strand die for pellet preparation / Slit die available
- **Direct connection with lab injection molding machine**
(MKE Mini-Ject)
- Motor power: 3.5 kW
- 600 rpm, Max. 400 °C
- MKE i-RheoComp® O/S adopted
: Automatic control & DAS
(Plastics Industry 4.0 compatible)
- **Windows11, MS Excel embedded PC system (일체형)**
- Process data storing and retrieving system
- QR code tag system : Experiment identification (optional)
- Smart DAQ System for Laboratory management

MKE 실험실용 미니컴파운더



i-RheoComp®



실험동영상 링크 :

https://youtu.be/4Wy4o_cOu9o?feature=shared

MKE

(MKE Mini-Compounder : 2~4 kg 펠렛 제조)

Co-rotating Twin Screw Compounder
for small size continuous compounding
Compounding Solution with Smart O/S
(4th Industrial Revolution Compatible System)

<Best model with 'kneadiBling blocks' & 'side feeding'>
MKE MiniCompounder- /Comp (Blending & Compounding)

- Throughput : 2~ 4 kg (소재 및 조건 별로 상이함. Min. ~500 g)
- Side feeding system available
- Strand die for pellet preparation / Slit die available
- **Direct connection with lab injection molding machine**
(MKE Mini-Ject)
- Motor power: 3.5 kW
- 600 rpm, Max. 400 °C
- MKE i-RheoComp® O/S adopted
 - : Automatic control & DAS
 - (Plastics Industry 4.0 compatible)
- **Windows11, MS Excel embedded PC system (일체형)**
- Process data storing and retrieving system
- QR code tag system : Experiment identification (optional)
- Smart DAQ System for Laboratory management

MKE 실험실용 지능형 컴파운더 (MKE Intelligent-Compounder : Blending)

[Polymer Blend application]



Co-rotating Twin Screw Extruder for Intelligent Compounding Solution with Smart O/S (4th Industrial Revolution Compatible System)

- Barrel Diameter 19, 25 mm, L/D 32~
- Throughput : depends on test materials
: 5~6kg/hr (300rpm) , 20 kg/hr (600rpm)
- Motor power: 7.5 kW, 600 rpm, Max. 400 °C
- MKE *i-RheoComp*® O/S adopted (Optional)
: Automatic control & DAS (Plastics Industry 4.0 compatible)
- Windows 10, embedded PC system
- Process data storing and retrieving system
- Data connection through networking using TCP/IP connection
- QR code tag system: Experiment identification
- Smart DAQ System for Laboratory management

<Blending 용 : *no side feeding* system>

MKE



i-RheoComp®



MKE V-Feeder
(TSF, SSF)

MKE 실험실용 지능형 컴파운더 (MKE Intelligent-Compounder : Compounding)

[Polymer Compounding Application]



<Compounding 용 : w/ side feeding system>

MKE


i-RheoComp®

Co-rotating Twin Screw Extruder for Intelligent Compounding Solution with Smart O/S (4th Industrial Revolution Compatible System)

- Barrel Diameter 19, 25 mm, L/D 36 ~
- Side feeding system, vent port, liquid injection ports available
- Throughput : depends on test materials
: 5~6kg/hr (300rpm), 20 kg/hr (600rpm)
- Motor power: 7.5 kW, 600 rpm, Max. 400 °C
- MKE *i-RheoComp*® O/S adopted (Optional)
: Automatic control & DAS (Plastics Industry 4.0 compatible)
- Data connection through networking using TCP/IP connection
- QR code tag system: Experiment identification (optional)
- Smart DAQ System for Laboratory management



MKE 지능형 반응압출 컴파운더 (MKE Intelligent-Compounder : Reactive extrusion)

[Special Compounding Application]

**Co-rotating Reactive Twin Screw Extruder
for Intelligent Compounding Solution with Smart O/S
(4th Industrial Revolution Compatible System)**

NEW

- Barrel Diameter 19, 25 mm, L/D 36 ~
- High pressure liquid injection and vent ports available
- Essential for high accuracy liquid injection system and high-performance vacuum system
- Throughput : depends on test materials
: 5~6kg/hr (300 rpm/600rpm)
- Motor power: 7.5 kW, 600 rpm, Max. 400 °C
- MKE *i-RheoComp*® O/S adopted (Optional)
: Automatic control & DAS (Plastics Industry 4.0 compatible)

[MKE Liquid Injection System for Reactive Extrusion]

[Two type of Liquid injection system]

1. LI-AP (Atmosphere pressure)
; 2 liter/hr
2. LI-HP (High pressure, 100 bar)
; 600 cc/hr
(Essential for high accuracy liquid injection
for small amount of liquid additives)



MKE


i-RheoComp®

MKE 실험실용 소형 사출 성형기

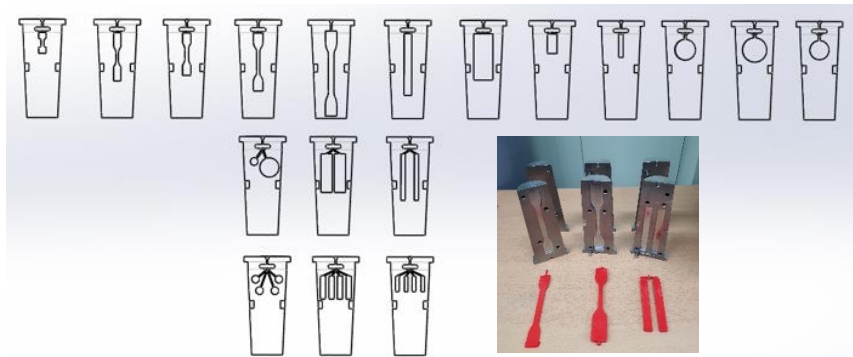
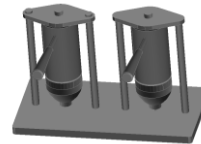
(MKE Mini-Ject : 소형 물성시험편 제작)

시험제작용 실험실용 사출 성형기

- Shot volume: 3.5 to 20 ml
- Two ways melt accommodation
 - Conduction melting
 - Transfer from micro compounder
- High injection pressure (1,600 bar)
- Max temp. : 360 °C / 250 °C
- Dual melt transfer unit (w/ cradle)
- Easy cleaning
- Low noise: < 50 db
- Versatile mold selection
 - ASTM, ISO complies
 - Rheometer specimen
 - DMA sample
- Suitable for SuperEP research
- High speed injection option available
- Compatible with other brand (X_ or H_ system)
- Injection Control Device (optional)

실험동영상 링크 :

<https://youtu.be/c-X5zpYJIUI?feature=shared>



MKE 자동제어 실험실용 소형 사출 성형시스템

(MKE Mini-Ject Pro : 자동제어 방식 물성시험 제작)



i-RheoComp®

자동제어/DAS 장착 소형 사출 성형기

- Shot volume: 3.5 to 20 ml
- Two ways melt accommodation
 - Conduction melting
 - Transfer from micro compounder
- High injection pressure (1,600 bar)
- Max temp. : 360 °C / 250 °C
- Dual transfer unit
- Easy cleaning
- Low noise: < 50 db
- Versatile mold selection
 - ASTM, ISO complies
 - Rheometer specimen
 - DMA sample
- Suitable for SuperEP research
- High speed injection option available
- Compatible with other brand (X_ or H_ system)
- Injection Control Device (optional)



- Computer control and DAS system in the same machine
- Precise injection pressure control via advanced computer
- Process monitoring for injection stroke, injection pressure, mold temperature and etc.

대체육 개발용 트윈 압출기 (HMMA/TVP Twin Screw Extruder : 건식, 습식 식품 압출)

[High Moisture Meat Analogues / Texturized Vegetable Proteins Application]



Main Features of Extruder

- Barrel Diameter 25 mm, L/D 40
- Parallel co-rotating type
- Open barrel type with additional ports
- Throughput : depends on materials & processing condition (~20 kg/hr)
- Motor power: 7.5 kW, 600 rpm, Max. 400 °C
- Max. screw speed : 10-600 rpm or 10-1000rpm
- MKE *i-RheoComp*® O/S adopted
 - : Automatic control & DAS
 - (Plastics Industry 4.0 compatible)
- Dimensions : 1850*1500*1800 (mm)

Special Modification for Food Processing

- Special material for food processing
- Barrel design for food extruder
- Hydro injection port for barrel

Cooling Die

- Modular liquid cooled slit die (Clamshell type)
- Cooling water connection with one touch coupling

MKE



i-RheoComp®

MKE 스크류레오미터 (MKE Screw Rheometer)

MSR (Melt Screw Rheometer)
RSR (Rubber Screw Rheometer)
SSR (Slurry Screw Rheometer)
스크류 방식 전단점도 측정장비

Shear Viscosity Function

Viscoelastic property

Reproducibility within +/-2%

Shear rate range

: 0.1~10 / 1~100 / 10~1000 [1/s]

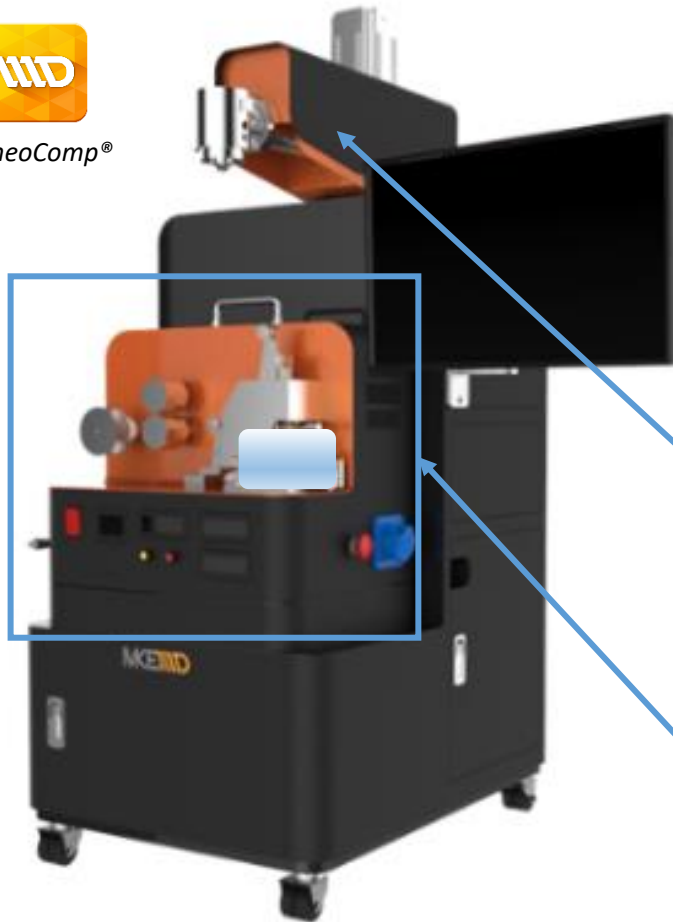
절대값으로 이용하는 점도측정 데이터
생산 제품의 품질기준 적합성 평가
컴파운드의 분산성, 가공성 평가
전단 점도 측정을 통한 처방(recipe)별 비교
Rubber/Elastomer/Plastics 원료의 특성 파악
첨가제의 가공성 영향 평가
쉬운 Carreau model fitting



MKE

MKE 용융강도 측정시스템 (Melt Strength Measurement)

(MS-ELVis Station)



MKE MS-ELVis Station

Melt Strength (Elongational Viscosity) 측정장비

MS EL-Vis Station은 상부에 장착된 싱글압출기에서 토출되는 일정량의 압출 스트랜드를, 일정한 가속비를 이용하여 권취하면서 가해지는 load를 측정하여 용융강도를 측정하게 되며, 단위는 cN (centi-Newton)을 사용하여 결과를 리포팅한다

측정 오차한계 : 0.1 cN

컴퓨터 제어 가속 설정 가능 : Speed 1,500mm/sec

상부 :

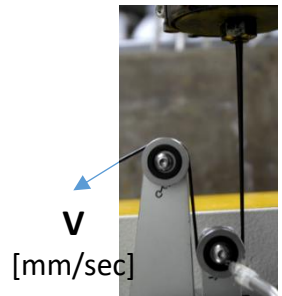
Strand 생성용 소형 단축 압출기 유닛

하부 :

Melt Strength 측정용 MS-ELVis
(독일 G사의 "RHEOTENS" 해당 유닛)

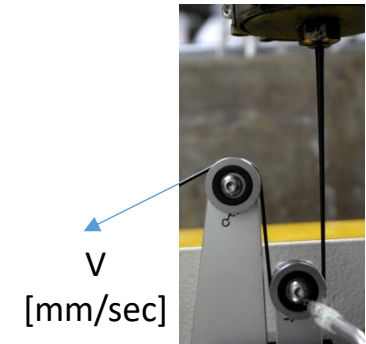
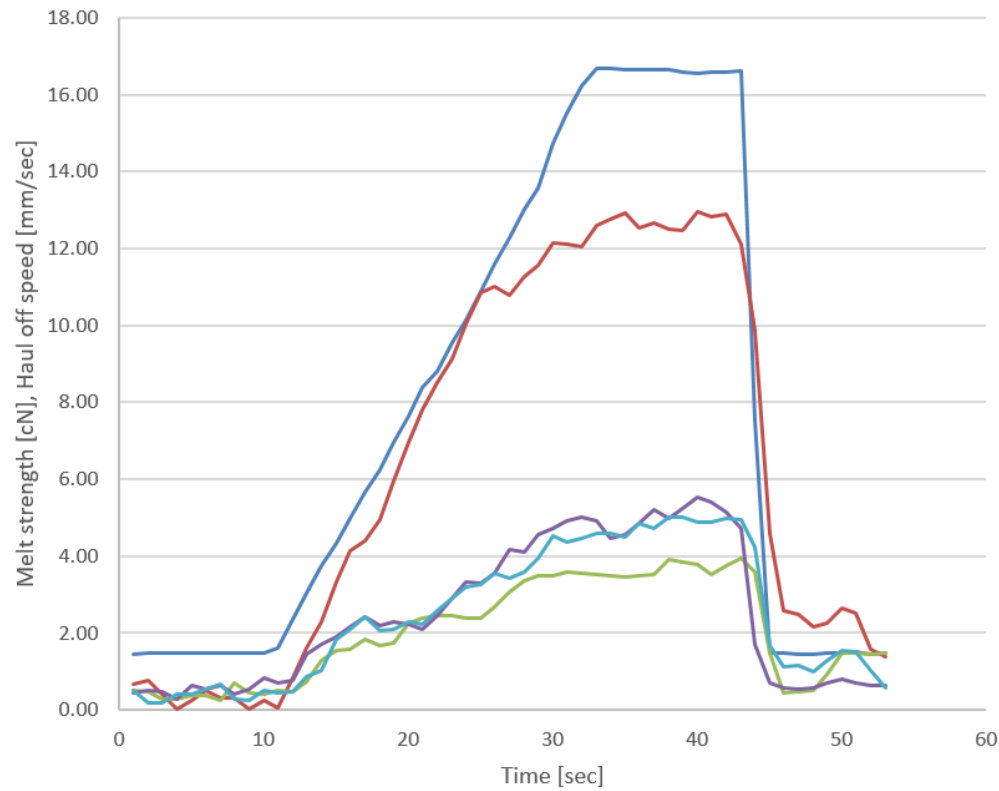
- MS-ELVis 단독형의 경우는 외장형 PC 사용
- MS-ELVis Station의 경우, 내장 PC 및 일체형 모니터 사용

- ❖ 특허 출원 전인 관계로 모자이크 처리된 것을 양해해 주시기 바랍니다.
- ❖ 납품 제품의 외관 디자인은 다소 변경될 수 있습니다.

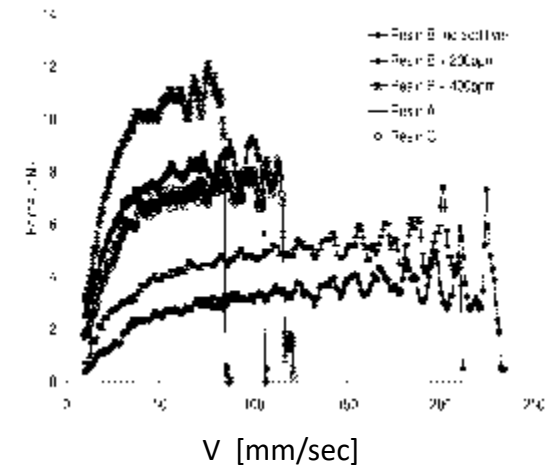


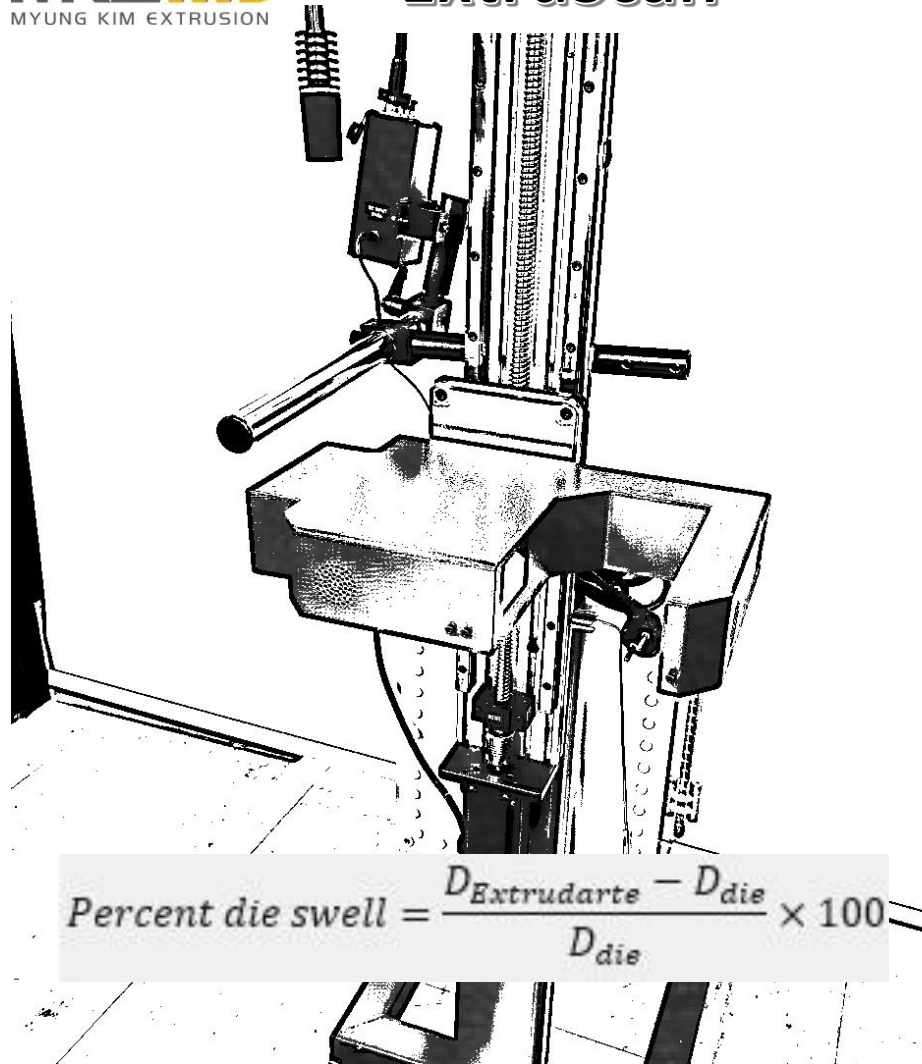
MS EL-Vis Sample Data

Melt Strength - LDPE
MS EL-Vis



Tension load 측정



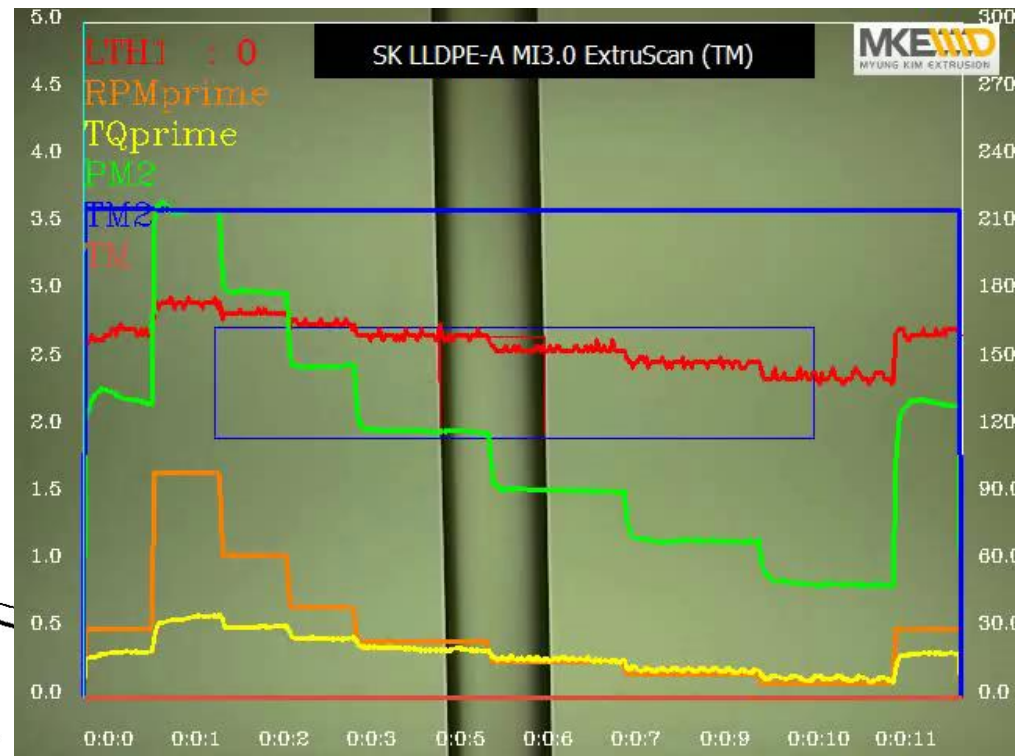


고분자 원료의 elasticity 측정 지표인 '압출 팽윤' 측정 (ASTM D 3835)
캐필러리 다이 토출 방식 기기에 부착하여 사용

Capillary rheometer,
Extrusion Capillary rheometer
Strand extrusion dies 등

- Laser 유도 비전 기술
- MKE의 i-RheoComp[®] 사용, 복수의 데이터 비디오 제작 (하기 예시)

<https://youtu.be/U4wtbUnM1OE>



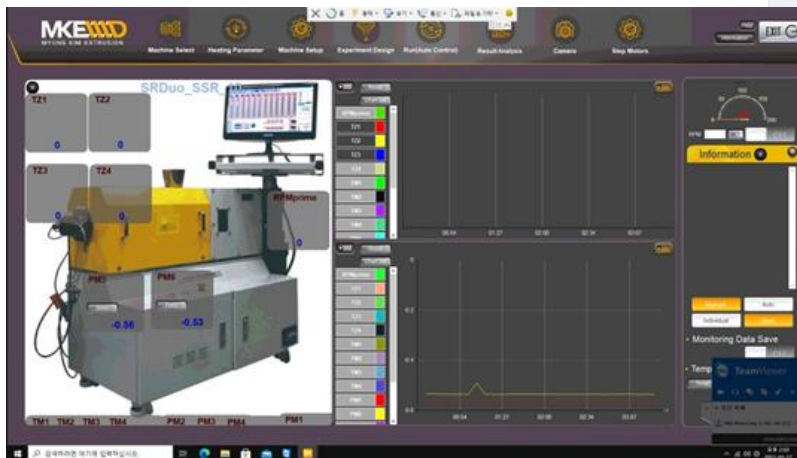
MKE 통합 O/S

(i-RheoComp®)



MKE i-RheoComp® O/S

- 실험 프로토콜 입력 및 자동 실행
- 온도, 압력, rpm, 토크 등 데이터 실시간 모니터링
- 자동 그래프 출력 기능
- 추후 당사의 'RheoProcess GrandMaster' 시스템 구축 시, 해당 컴퓨터에서 모든 공정 데이터의 통합 관리가 가능함



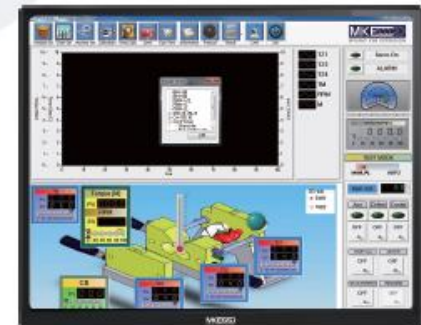
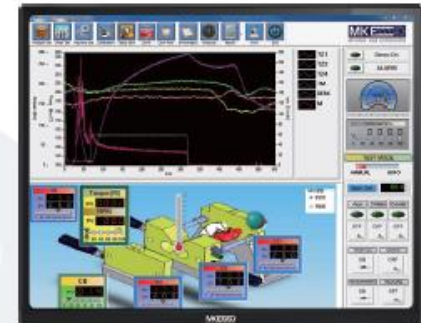
i-RHEOCOMP® / FREEDAQ

"i-RheoComp® is a brain of command station", which controls all "plug modules" and additional sophisticate processing devices.

"i-RheoComp®" Provides

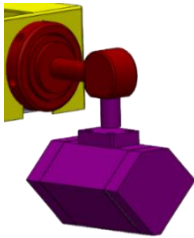
- ▶ Precise control for motor and barrel temperatures
 - ▶ Easy selection of data type - rpm, torque, barrel temperature, melt temperature, water flow rate, and melt pressure
 - ▶ Imbedded scheme for process
 - ▶ Viscosity calculation for screw rheometer
 - ▶ Overlay view with process chart and viewfinder
 - ▶ 'Report generator' based on hand on experience of engineer
 - ▶ Easy handling of experiment database
 - ▶ Spreadsheet and CVS file export for further analysis
 - ▶ Built in movie maker for BIM and PBIM mixer
- Find "torque rheometer" in YouTube

MKE
MYUNG KIM EXTRUSION



Post Extrusion Equipment & Accessories

(T-die, Strand Winder, Sheet Stacker, Feeder, Pelletizer, etc.)



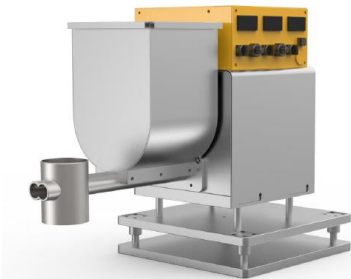
T-dies (Film or Sheet)



Strand Winder (EzWinder)



Smart Waterbath



**Volumetric Feeder
(Twin Screw Feeder)**



Compression Molding



Pelletizer

RheoStation® H-SOM® (Hot-staged Scanning Optical Microscope)

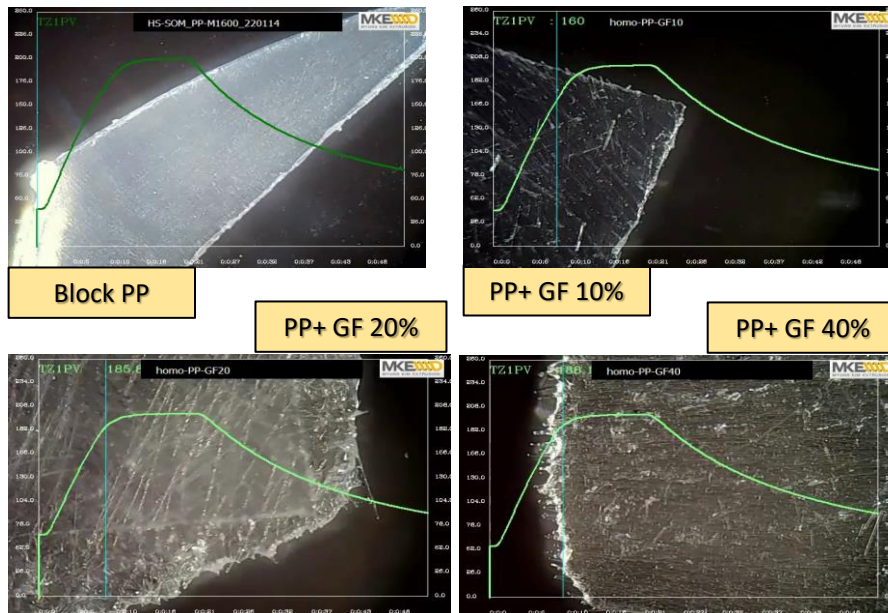
DSC 대응으로 Tm 측정이 가능

- Observation with temperature variation
- Morphology analysis
- Maximum temperature ~400 deg C
- No temperature overshoot
- QR-code Tagging system
- Scan area : 10 x 10 mm

MKEWD



Customized solution for used microscope



Total System including Microscope

RheoStation® H-SOM

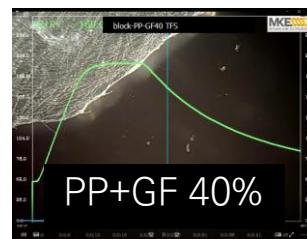
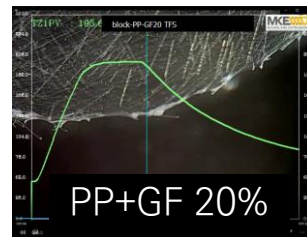
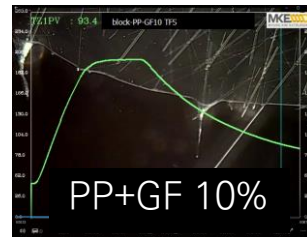
(제품 특징 및 적용 분야)



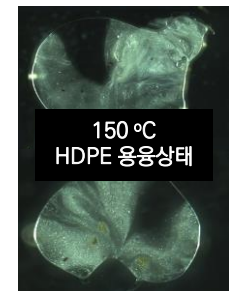
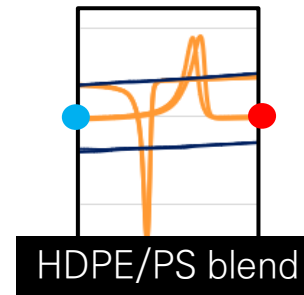
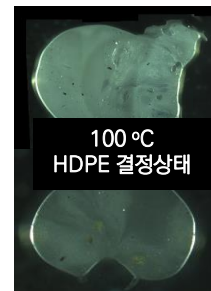
Special Feature

Application Area

- Polymer blend morphology
- Plastic compound - filler dispersion, additive dispersion
- Polymer Crystallinity, recrystallization study
- Fiber observation



- Graph-video overlay 기능을 통한 직관적 현상 파악
- 실시간 온도 표시
- 자체 소프트웨어를 이용한 쉬운 video making (*i-RheoStation®*)
- 40 step의 온도 프로그래밍을 이용한 세밀 조정
- Manual X-Y stage
- Light type: reflection, stereo, UV
- 측정 데이터의 Database 관리
- Fast electric heating and Fast air cooling
- Sample 별 QR code 생성
- Option: Add-on polarizer, High temperature "Heating Plate", Motorized X-Y moving plate



H-SOM (Hot-staged Scanning Optical Microscope) - PET

실험 동영상 참고

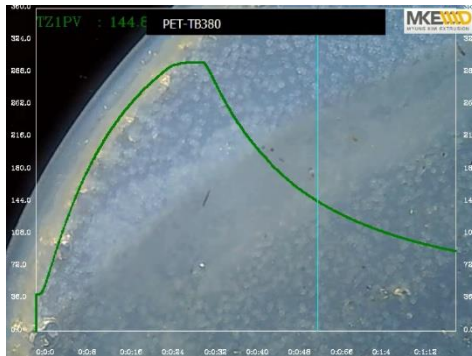
<https://youtu.be/occHquoDXYU?feature=shared>

“Moment of Polymer Melting”

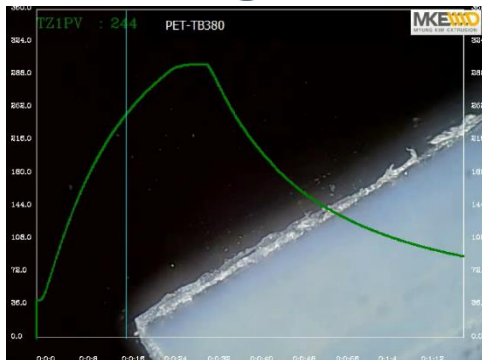
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“Moment of Crystallization”

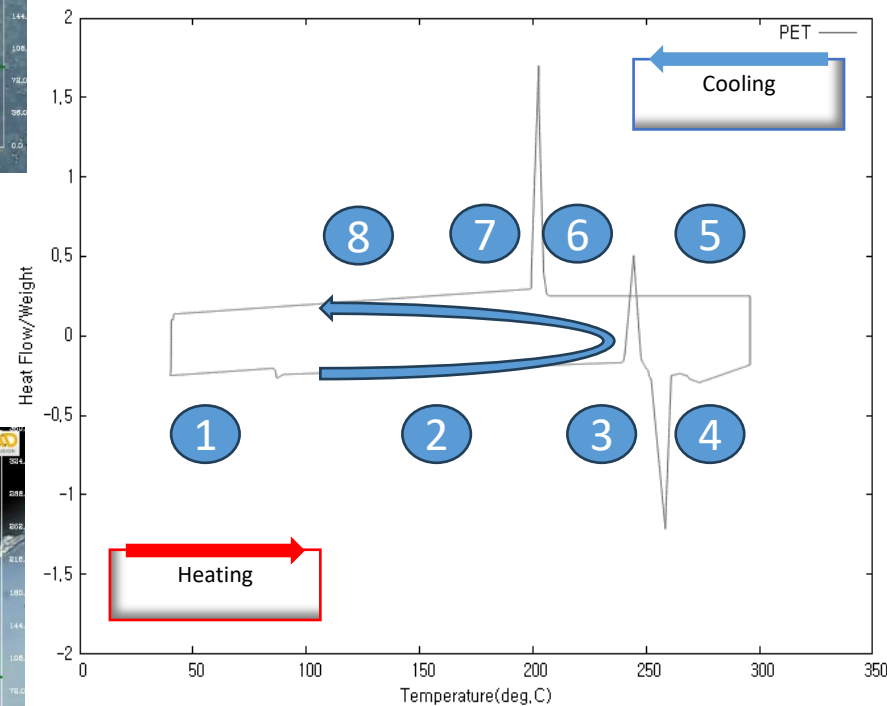
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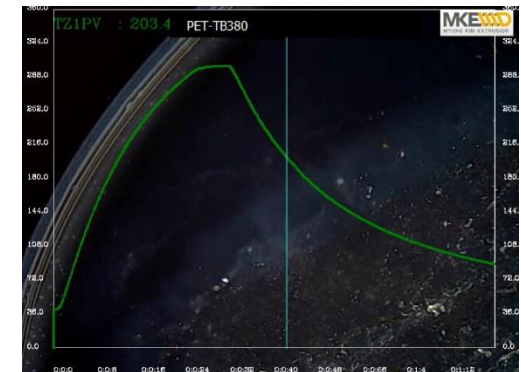
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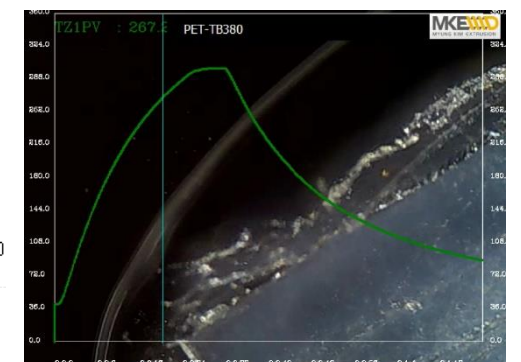
3



8 7 6 5
1 2 3 4



6



4

Digital Material Center

(Polymer Properties Measuring System for Digital Twin)

MKEMD

NEW

(DMC Capillary Rheometer)

ASTM D3832 / ISO 11443

모세관방식 전단점도 측정장비

- Shear Viscosity Function
- Cross-WLF/Arrhenius model fitting
- Extrudate swell
- Melt Strength
- Density meter

(DMC Thermal conductivity)

ASTM D5930

Transient Line Source Method

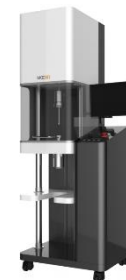
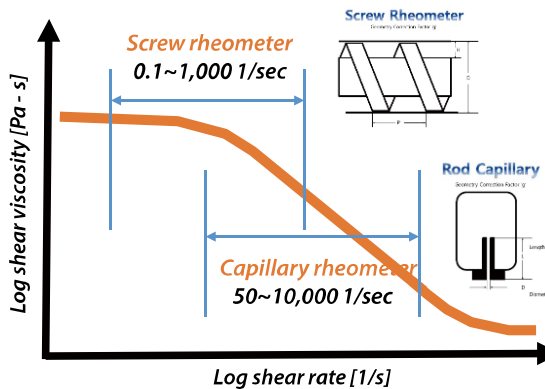
- Thermal conductivity of polymer melt and solid
- Temp. range: 30 ~ 350 °C

(DMC P-v-T)

Pressure-volume-Temperature
Tait equation fitting

- Temp. range: 30 ~ 350 °C
- Pressure: 2 MPa ~ 200 MPa

[Viscosity Measurement Range]



Testing Service
물성측정서비스 제공

3-in-1 Combination
or
Separated Model



DMC Capillary

(캐필러리 레오미터 : 모세관 방식 고분자 전단점도 측정)

MKEMD

(DMC Capillary Rheometer)

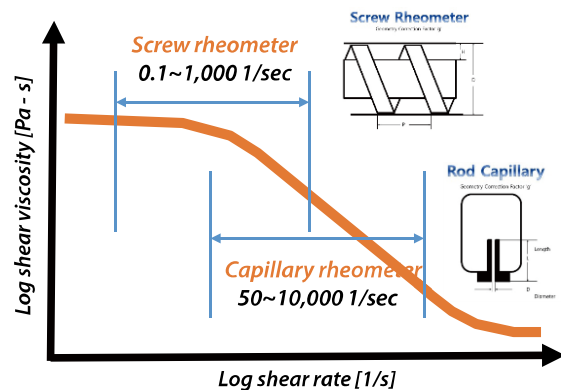
ASTM D3832 / ISO 11443

모세관방식 전단점도 측정 장비

- Shear Viscosity Function
- Cross-WLF/Arrhenius model fitting
- Extrudate swell
- Melt Strength
- Density meter



(Viscosity Measurement Range)



Capillary Rheometer의 종류

구동 방식

압력 측정 방식

모터 구동(MD)
유압식 구동(HY)
압출기 구동(EX)

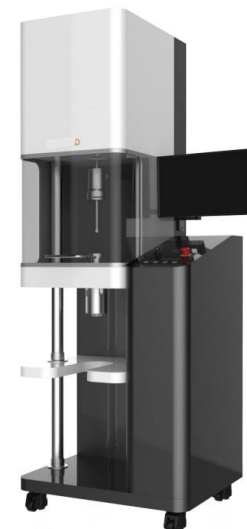
로드셀 방식(LC)
압력계 방식(PT)

당사 권장모델 : MD-PT

(모터 구동 / 압력계 방식)

외산 로드셀 방식 대비 탁월한 성능/ 합리적 가격/
신속한 AS
(고객 요청 시 모든 사양에 대한 맞춤 제작 가능)

i-RheoStation®

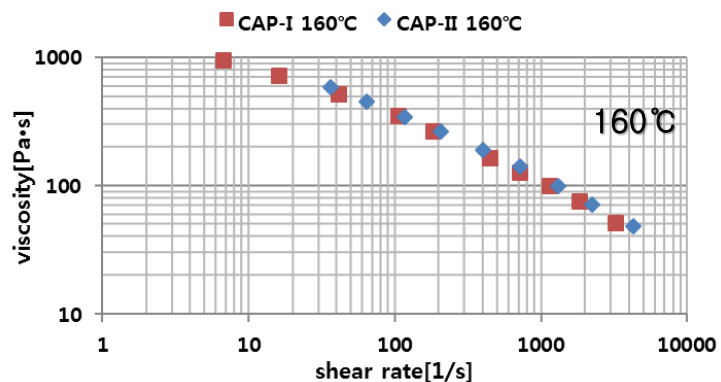
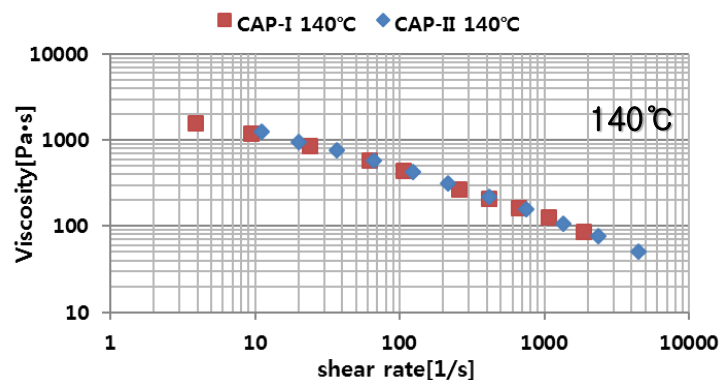


DMC Capillary Sample Data

(DMC Capillary MD-PT Vs. Goettfert Rheograph 20)

CAP-I : DMC Capillary (모터구동, 압력계 type)

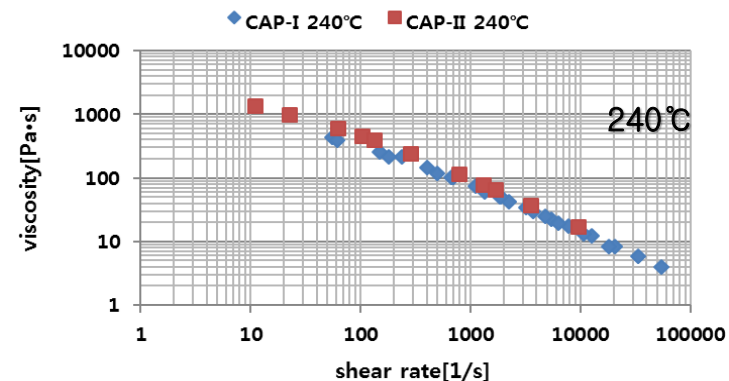
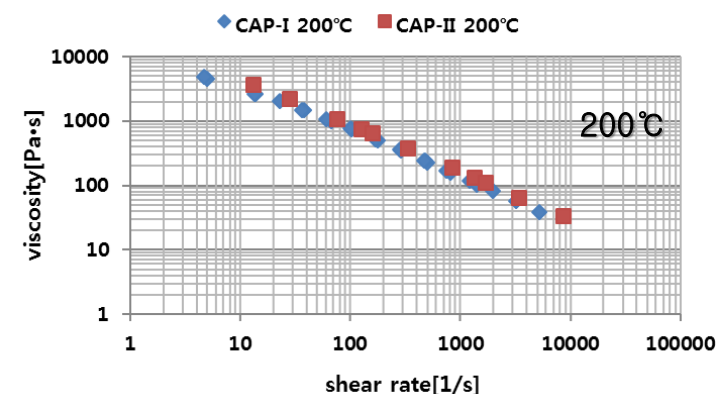
CAP-II : Goettfert Rheograph 20 (모터구동, 압력계 type)



LDPE MI 10g/10min



MKEMD



GPPS MFR 5.5

RheoStation® FREEDAQ

(Automatic DAS System for Lab. Equipment)



RheoStation® FREEDAQ

(연구장비 자동 데이터 취득장치 : 실시간 모니터링 & 리포팅)

- 이동식 모델(Portable)과 장비 내장형 모델(Built-in)
 - 실시간 데이터 모니터링 및 간편 리포팅 기능
(온도, rpm, torque, 압력 등 사용장비 별 선택 가능)
 - Windows 11 based O/S
 - MS Office 탑재, Excel 호환 데이터 양식
 - Built-in industrial computer for harsh environment
 - Control for three electric heating/air cooling and/or PID controller (customization available)
 - DAS (Data Acquisition System) included
 - 단독형 모델 (휴대용) 혹은 기존 장비 내부 장착형 두 가지 모델
-
- 데이터 수집 속도
: 각 센서별로 초당 1 회 이상의 데이터획득
(필요에 따라 초당 0.1 / 1 / 5회 선택 가능)
 - 데이터 전송 인터페이스
: 컴퓨터 to 네트워크=> LAN선을 이용한 TCP/IP 전송
실시간 외부 전송 가능



RheoStation® FREEDAQ Portable

(Portable Data Acquisition System)



FREEDAQ connection body

Data type

- K-type, J-type Thermocouple 4 ea
- Pressure or Load cell 4 ea
- RS 485 communication
- 4-20 mA Analog data: 10 ea
- ❖ Motor amperage
- ❖ IR thermocouple

Flexible Rearranging Element Enhance Data Acquisition System

휴대용 DAS (Data Acquisition System)

RheoStation® FREEDAQ Portable model은 휴대용 DAS로서 DAS가 설치되어 있지 않은 Extruder, Compounder, Injection Molding, Blow Molding 등 기존 양산 장비에 Digital Processing Data를 저장할 수 있는 DAS system 구현하기 위한 용도임

본 장비를 이용하여 가공 장비 운용 중 시간에 따른 공정데이터를 컴퓨터에 저장하여 볼 수 있음

본 기기의 특징

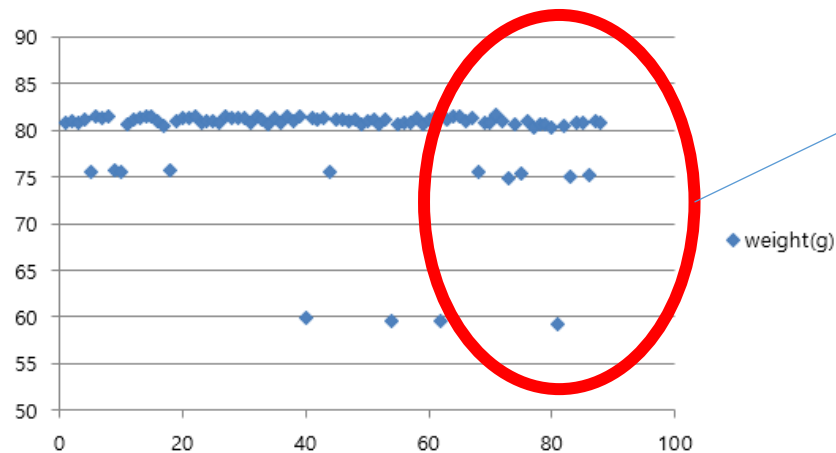
- ❖ 사용하기 간편함
- ❖ 저장 데이터의 다양한 이용 가능
- ❖ Excel, 또는 text file로 변환 공유가능
- ❖ 높은 경제성
- ❖ 이동이 용이함: ~ 30kg
- ❖ 다양한 공정 데이터의 기록
- ❖ 시간에 따라 천천히 변화하는 데이터의 기록
- ❖ 시간에 따른 trend data의 확인
- ❖ 공정 데이터의 통계학적 처리
- ❖ Recipe에 따른 공정 데이터 변화의 기록
- ❖ 양산 데이터의 보고서화

RheoStation® FREEDAQ Portable

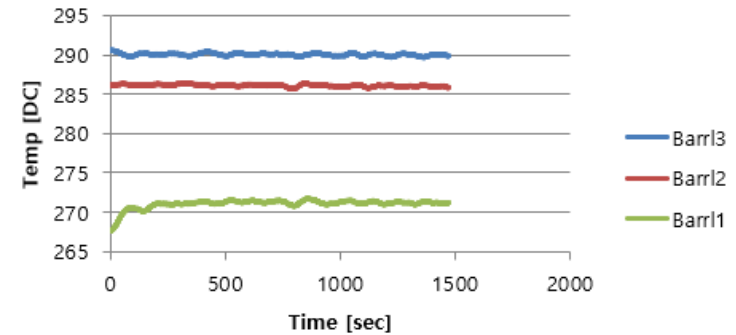
(Application Example)



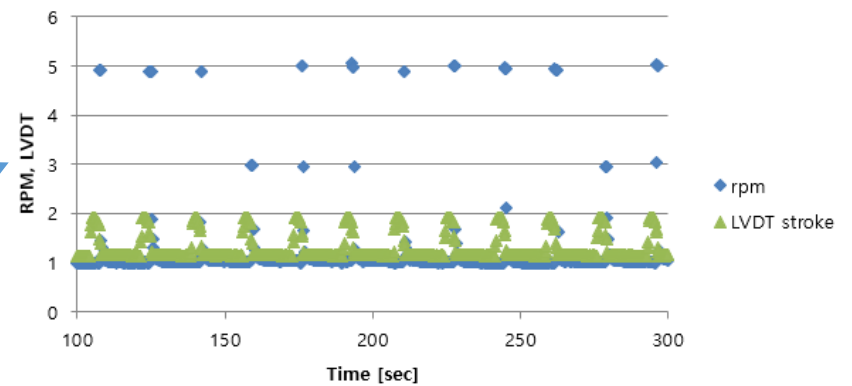
양산용 사출성형기에 FREEDAQ을 장착하여 실험하는 모습



PPS A575W20 Barrel Temp

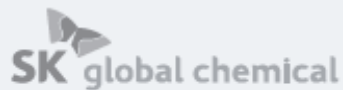
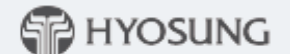
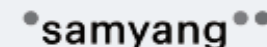
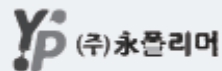
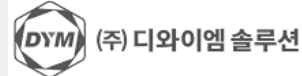
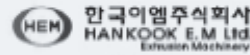


PPS A575W20



Injection molding시 발생하는 시편 무게 편차가
screw rpm의 변화와 관련이 있음

ExxonMobil



MKE 시스템 장비 및 기술서비스 납품 고객사 (김명호 대표 기술개발프로젝트 수행 업체 포함)



MKE Hardware Applications

- 4차산업혁명 대응을 위한 실험데이터 통합 관리시스템 적용 -
(신제품개발, 생산성향상, 원가절감, 납기단축을 위한 실험장비 솔루션)

2021.



토크레오미터 시스템 (배치믹서 모듈 포함)

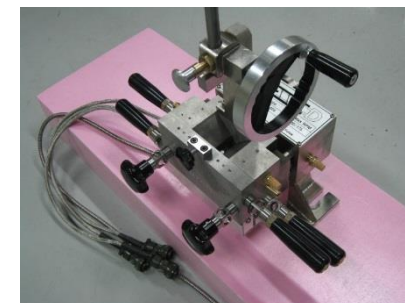
MKE



MKE Torque Rheometer System

RheoComp® Concerto-Nano

(Batch mixer station + Command Station, 2018 model)



BIM-150



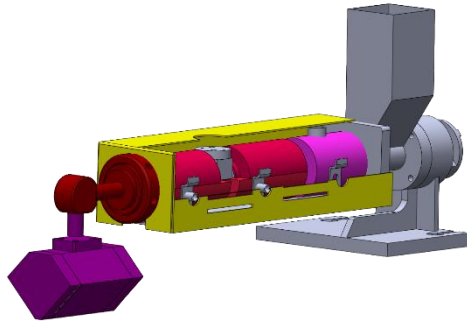
Blade set



BIM-350

RheoComp® Concerto 확장가능모듈 (단축압출기 모듈 – Plastics, Rubber)

MKEWD



SSE19 + Deflection Head + T-die



SSRE19 (Rubber Extruder)



SSE19 (Strand die) + Command Station



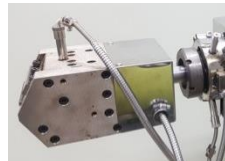
RheoComp® Concerto 확장가능모듈 (단축압출기 모듈 - 필름 성형 연구개발)



EzCast Mini
(Lab. Caster)



EzCast BF
(Pilot Blown Film)



T-dies

EzCast V.1
(Pilot Caster)



SSE19



RheoComp® Concerto-Nano

Lab. or Pilot Film Casting/Blown System ← T-die ← SSE19 ← RheoComp® Concerto (Command Station)

필름라인만 구축할 경우에는 구동본체와 압출기 파트를 <일체형 압출시스템>으로 구성하는 것이 보다 경제적인

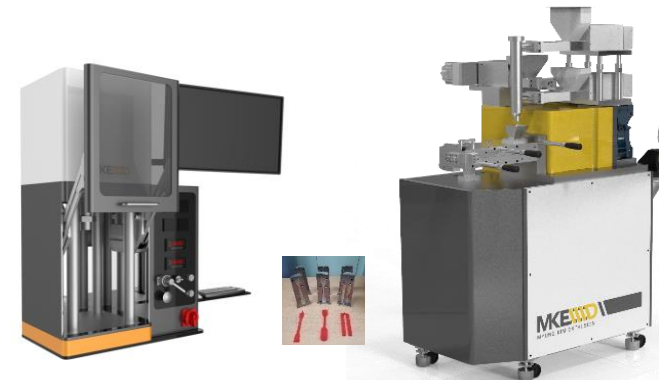
RheoComp[®] Concerto-Nano 확장가능모듈 (양축압출기 모듈 – 컴파운드 개발, 펠레타이징 시스템)

MKEWD

RheoComp[®] Concerto-Nano + Co-TSE19 + Smart Pelletizing System



RheoComp[®] Concerto-Nano + Mini-Compounder + Mini-Ject
(Combinatorial compounding R&D)





RheoComp® Nano



RPE- I & II
Rubber & Elastomer

RheoComp® Harmony/Concerto/Nano RheoComp® Modules

Batch Internal Mixer(BIM series)
 Powder Batch Interna Mixer(PBIM series)
 Single Screw Extruder
 Vented Single Screw Extruder
 Single Screw Rubber Extruder
 Pin Barrel Single Screw Extruder
 Co-rotating Twin Screw Extruder
 Counter-rotating Twin Screw Extruder
 Micro-Compounder

Stand-Alone Equipments & Devices

Micro-Compounder
 Intelligent Compounder
 Mini-Ject (Mini-Injection Molding Sys.)
 EzCast Mini(Lab Film Casting Line)
 EzCast (Pilot Film Casting Line)
 EzCast BF (Pilot Blown Film Line)
 Melt Screw Rheometer(MSR)
 Rubber Screw Rheometer(RSR)
 Slurry Screw Rheometer(SSR)
 EzComp(Compression Molding)
 RheoSation
 Digital Material Center
 MS EL-Vis Station (Melt Strength)
 FREEDAQ(Data Acquisition System)

MKE Rheology Solutions

Shear Viscosity, Viscosity Function
 Melt Strength, Elongational Viscosity
 P-V-T
 Thermal Conductivity
 Melt Density, Bulk Density

감사합니다 !!!



Best Solution, Best Partner!!!

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