Plastics Processing

Thermoplastics (Tampere)
Plastics processing

- Micro-scale melt processing
- Small Scale Processing
- Pilot Scale Processing
- Injection Moulding
- Extrusion
- Pre- and Post-processing

Thermo-Haake MiniLab Micro Compounder
Injection moulding
Collin(30 x 25D) blown film extruder
Micro-scale melt processing

Thermo-Haake MiniLab Micro Compounder
- speed range: 1 ... 360 rpm
- torque max.: 5 Nm / screw
- extruder design: conical, co-rotating
- pressure: up to 200 bar
- temperature: max 350 °C
- volume: 5.5 ccm

Picture. MiniJet injection moulding machine (on the left). MiniLab Micro Compounder (on the right)

Picture. Moulds from left to right: Tensile testing bar, Impact strenght testing bar, DMA flexural testing bar, DEA (Dielectric analysis) testing bar, DMA tensile testing bar and Thermal conductivity testing bar.

Thermo-Haake MiniJet Injection Moulding Machine
- <5 g micro-batch processing and injection molding to produce micro test samples
- Temperatures: Cylinder max 400 °C, Mould max 250 °C (no cooling)
- Injection Pressure: up to 1200 bar
- Injection time and post pressure time are adjustable
Small Scale Processing

Brabender Plasti-Corder PL 2100-6 mixer
- Small size, high temperature and large measuring head
  (W50 EHT and W350 EHT, respectively)
- Extrusion head (single-screw Extrusiongraph 19/25 D), four dies, belt take off
- Counter rotating twin-screw compounder head (DSK 42/6).

Batch mixers
- Two-roll mill, laboratory size,
- Banbury mixer, 2-3 l,
- Papenmeier high speed mixer, 5 l,
- Different size ball mills for minerals, metals and polymers.
Pilot Scale Processing

**Pilot production** (up to 100 kg)

**Co-rotating twin-screw compounder Berstorff ZE 25 x 48 D**
with gravimetric feeders, liquid feeding pump, vacuum, water bath, pelletizers (strand cutter) and grinder

**Co-rotating twin-screw compounder Berstorff ZE 25 x 33 D**
with gravimetric feeders, forced feeder, liquid feeding pump, vacuum, water bath, air cooling possibility and pelletizer

**Co-rotating twin-screw compounder Werner & Pfleiderer ZSK 40 F32,5E**
with gravimetric feeders, forced feeder, 20 mm side feed extruder, liquid feeding pump, vacuum, water cooled metal belt conveyor and pelletizer.
Up to 50 kg/h (current screw profile only 20 kg/h).

**Dry material mixing**
**Forberg mixer**
40 l with pin mills,
Moisture control and additives to fibres,
Mixing time 0,5-2 min.
Injection Moulding

Engel ES 200/50 HL
- 50 tons clamping force
- 25 mm screw
- control unit CC100
- instrumented mould having interchangeable inserts (according to ISO standards)

Demag Ergotech 100/420-120 EL Exis S
- 100 tons clamping force
- 22 mm screw
- maximum injection speed 1000 mm/s
Extrusion

Films, Coatings and Profiles

**Dolci extruder**
- 300 mm wide sheet preform
- 3-layer film (A – B – A)
- N₂-rinsing possibility
- Chemical and physical foaming
- Dry or water bath cooling
- Extrusion coating on cardboard

**Brabender extruder**
- 100 mm and 120 mm wide sheets preform and roundstrip
- Masterbatch production
- Max 400 °C
- 4 screw geometries with different compression
- Clean room possibility

**Collin(30 x 25D) blown film extruder**
- One layer
- Max 280 °C
Pre- and Post-processing

Drying
- Convection ovens
- Dehumidifying dryers
- Vacuum drying
- Freeze-drying

Milling
- Hosakawa Alpine
  - Separating mill 100 g – 30 kg/h,
  - Particle size 0.5 - 10 μm,
  - Powder grading.

Orientation
- MD-streching unit
  - Modified stretching interval
  - On-line stretching from extrusion line
- Biaxial laboratory stretcher Brückner (KARO IV)
  - Computer control and force measurement
  - Speed 0.5 - 40 m/min

AC-Corona film treatment
Atmospheric Plasma treatment unit
Characterization and Analysis

SEM image of a PP film with nanostructured POSS®-chemical
Characterising and Analysing Availability

Mechanical testing
- Tensile testing (with oven)
- Impact strength, Charpy
- DMA Dynamic mechanical analysis

Material properties
- DSC Differential scanning calorimetry
- TGA Thermogravimetry
- Melt Flow Tester (Indexer)
- DEA Dielectric analyser
- Capillary rheometer
- X-ray diffraction (XRD)

Microscopy and particle size analysis
- SEM (with low vacuum mode)
- AFM
- Optical microscopy
- Particle size distribution analyser

Spectroscopy
- FTIR (micro-ATR)
- UV / VIS
VTT creates business from technology