Projects

Dow Horgen – November 2017

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Campus of Industrial Innovation

- Campus Program dedicated to selected **master students**
- **9-12 months experience** in a global corporation
  - Several weeks of dedicated **training programs**
  - Personal accountability for challenging **technical project** Projects suitable for master thesis
  - Dedicated local coach in stimulating R&D environment
- Perfect integration in mandatory university internship programs
- Opportunity to create a network with global connections
- Attractive compensation

Aim: Prepare talent for the industry
Find next talent for Dow

Projects: General information

- **Technically challenging projects**
  - Projects covering different applications ranging from durable to flexible, from hygiene and packaging to automotive
  - Polymers of focus:
    - polyethylene and ethylene based copolymers with acrylic acid, vinyl acetate, maleic anhydride,...
    - Wide range of density (from elastomers to HDPE), long and short chain branching distribution, molecular weight and viscosity profiles
  - Liquid chemistry systems of interest:
    - reactive polyurethane systems, acrylic based adhesive systems
    - wide range of solvent based, water based and solventless systems
    - wide range of monomers, reactivity and viscosity profiles

Projects: General information

- **Technically challenging projects**
  - Processes of focus:
    - Extrusion (blown & cast film, fiber spinning, extrusion coating, injection molding, sheet extrusion..)
    - Mono-axial and bi-axial stretching
    - Compounding
    - Hot melt adhesive lamination and reactive adhesive lamination of polyethylene based films on various substrates (e.g. oriented polyesther, oriented polypropylene, non-woven,...)
    - Fibers conversion technology into nonwovens
    - Packaging prototyping (e.g. pillow pouch, stand-up-pouch, ..)
  - Modelling and experimental projects focusing on:
    - structure property relationships
    - rheology
    - fracture mechanics
    - ...

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Project: H&H (pitch for engineers)

- Scope: Sustainable Health & Hygiene application
  Aim: Develop optimal thin airlaid structure for absorbent cores
- Modelling Part:
  - Model balance of forces during swelling of Super Absorbent Polymer (SAP) in 3D network of cellulose and polyethylene based fibers (= airlaid absorbent core)
  - Define optimal balance of forces to allow for complete SAP swelling
    Work within defined boundary conditions of stiffness in dry and wet conditions
  - Translate optimal balance of forces into hypothesis about mechanical properties / shape / amount of polyethylene based fibers
  - Translate further into hypothesis about molecular weight and density of polyethylene and fiber extrusion conditions

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More information on: http://www.faceofinnovation.com/active-comfort/

Project: H&H (pitch for engineers)

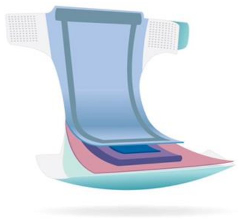
- Experimental Part:
  - Develop a testing methodology to measure absorbency
  - Based on model hypothesis, extrude different polyethylene based fibers
  - Based on model hypothesis, produce different 3D networks (SAP, cellulose, polyethylene based fibers) via airlaid technology
  - Measure absorbency of baseline structure versus new structures
    Validate model hypothesis

More information on: http://www.faceofinnovation.com/active-comfort/

Project: Elastomers

- Scope: Improve the Adhesion of Polyolefin Elastomer Based Hot Melt Adhesives.

  Aim: Develop Polyolefin Elastomer Structures for Hot Melt Adhesive Formulations with Improved Adhesion performance.



- Experimental:
  - Define Design of Experiment to evaluate novel polyolefin elastomers of varying design (MW, MWD, co-monomer,..) in hot melt adhesive (HMA) formulations used for bonding polyolefin based non-wovens.
  - Use statistical analysis to determine impact of Formulation and Elastomer Design on Adhesion Performance ,
  - Run characterization of linear and non-linear HMA viscoelastic properties, correlating adhesion performance to viscoelastic characteristics
  - The project will include HMA preparation, HMA application and Performance Testing and Viscoelastic Characterization.

Projects: Food & Specialty Packaging

- Scope: Leaker free pouches exposed to vibrations during transportation
  Aim: Develop packaging film structures with increased vibration resistance
- Experimental Part:
  - Test incumbent packaging structures (laminates) and pack formats like stand up pouches on a vibration table simulating road transportation.
  - Build a failure mode hypothesis for vibration fatigue in pouches and link it to film composition and polymer selection and material science.
  - Identify relevant scientific & engineering literature on packaging fatigue.
  - Develop a laboratory test method to simulate the mechanical fatigue packages experience on a vibration table.
  - Validate the hypothesis with a Design of Experiments to identify improved film formulations for vibration resistance

More information on: http://www.faceofinnovation.com/fresh-to-table/

Projects: Food & Specialty Packaging

- Scope: Sustainable All-PE pouches with highest pack integrity
  Aim: Improved pack drop resistance for recyclable PE based pouches
- Experimental Part:
  - Test All-PE packaging structures (laminates) and pack formats like stand up pouches on a pouch drop tester.
  - Investigate pouch failure modes via high speed image analysis and microscopy. Build a failure mode hypothesis for PE based pouches link it to film composition and polymer material science and FEM pouch drop simulations.
  - Develop a laboratory test method to simulate the failure mechanism All-PE pouches observed during pouch drop testing
  - Validate the hypothesis with a Design of Experiments to identify improved PE film and laminate formulations for pack integrity during drop testing.
  - Barrier polymers like EVOH can provide barrier in PE structures while still being recyclable.
    Develop drop test resistance film/laminate formulations with EVOH.

More information on: http://www.faceofinnovation.com/fresh-to-table/

Projects: I&CP

Project ideas (TAR, HGN):

- Understand physical properties of films under tension (important for load stability, I&CP several applications)
  Use of lab capabilities to:
  - Develop lab methods to keep films under tension in a controlled way to run other mechanical tests on them at that state. Focus on tear, impact and puncture.
  - Understand relaxation phenomena versus time and temperature
  - Good understanding of morphology at the stretched state. Quantitative morphological characterization (biaxial orientation, amorphous and crystalline phase...). How does molecular architecture of the PE (or blend components) affect such morphology? What is desirable for each key application?
  - Starting from a benchmark PE extruded film morphology, develop modeling of morphology evolution versus stretching and therefore physical properties
  - Understand physical properties of films under tension to optimize load stability during transport, and correlate them to stressed-morphology and original film morphology
  - Develop differentiated solution for primary and secondary packaging considering synergies between them (focus on stretch hood and stretch wrap vs HDSS)

More information on: http://client.dow.com/packagingmoveitsafely

Projects: Elastomers

- Scope: Competitive assessment for Polyolefin Elastomer (P.O.E)

  Aim: Map competitive performance space for POE in automotive bumper fascia

- Experimental Part:
  - Based on defined performance requirements, review literature and IP and establish map of existing POE used for automotive applications
  - Run chemical compositional analysis of defined POE (MW, MWD, rheology, crystallinity, co-monomer, LCB,…) and link to production process
  - Develop optimized experimental design that permits assessment of performance versus requirements for the defined POE used in automotive
  - Conduct compounding studies based on experimental design. Use statistical methods to analyse data
  - Run morphology investigation of compounds and comparisons of performance

Projects: Elastomers

- Scope: Development of Enhanced Polyolefin Elastomer (POE) for natural fibre filled Thermoplastic Polyolefin (TPO)
- Experimental Part:
  - Based on given stiffness/toughness targets, develop understanding and map of natural fibre types, which can be used as potential candidates for TPOs
  - Develop design of experiment and compounding strategies to asses relative performance of the TPOs
  - Define hypothesis about suitability of chemical modification of the POE to enhance bonding to fibre and improve final performance of TPOs
  - Conduct compounding experiments to produce TPOs
  - Complete characterisation of morphology as well as stiffness /toughness properties of TPOs.
    Analyse results based on statistical methods
  - Develop simplified model to predict optimal compositions based on experiments

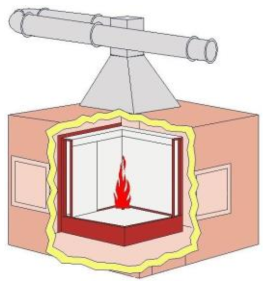
Projects: Elastomers

Scope: Development of high performance hot melt adhesive formulations

- Aim: Recipe development and performance evaluation of hot melt adhesive (HMA) formulations on different substrates
- Experimental Part:
    - Analysis of surface properties of substrates (e.g. cardboard types and other hard-to-bond surfaces)
    - Definition of chemical formulation of HMA for improved adhesion to the substrates
      Characterization of raw materials
      Definition of elastomer structure (MW, SCBD, Crystallinity,…) for improved adhesion
    - Characterization of adhesion/cohesion of improved HMA onto substrates
      Ageing and property testing of the structures
    - Statistical analysis of results
    - Summary and formulation recommendation

Project: Elastomers

- Scope: Halogen-free, fire resistant (HFFR), durable and radio-frequency weldable compounds for fabric coating, extruded profiles and injection molding



Desired Outcome

Development of EN Class B certified formulations on the Horgen Direct Extrusion Line.

- thin films (< 0.5 mm) and fabric coating compounds for infrastructure applications
- curtain wall profiles and tapes, roofing and waterproofing membranes.

Proposed work

- Review literature and IP in the EN Class B space
- Based on given requirements for EN Class B certification, define design of experiment (DoE) to produce compounds. Define hypothesis for the DoE
- Run compounds on laboratory Direct Extrusion line (twin screw extruder + sheet extrusion)
- Analyze rheology of components and processing behavior on the twin screw Validate initial hypothesis by analyzing final fire performance and mechanical properties of produced film.
- Define potential opportunity for IP
- Create cost model for the formulations and economic evaluation

Projects: Elastomers

- Scope: Traditional EPDM WS undergoes electrochemical corrosion due to contact between dissimilar metals on a car body
  Aim: Develop understanding of the factors influencing this corrosion
- Experimental Part:
  - Literature & patent review of electrically resisitive EPDM WS and compounds
  - Define hypothesis about factors influencing corrosion
    Define design of experiments (DoE) to test the hypothesis
    Boundary conditions:
    - Consider systems containing EPDM and white or black fillers
    - Consider synergy mechanisms between PDMS and EPDM chemistry
  - Generate data based on DoE and validate hypothesis
    Test mechanical properties of compounds as well
  - Define optimum formulation with best property profile
    Run cost model and validate against DoE results