# COURSE OVERVIEW PE0620
# Polyethylene & Polypropylene Manufacturing & Process Troubleshooting

## Course Title
Polyethylene & Polypropylene Manufacturing & Process Troubleshooting

## Course Date/Venue
Session 1: May 25-29, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
Session 2: November 02-06, 2025/Al Khobar Meeting Room, Hilton Garden Inn, Al Khobar, KSA



## Course Reference
PE0620

## Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

## Course Description

***This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.***

Polyethylene and polypropylene are the synthetics champions. These inert, food-friendly and easy-to-recycle materials make up more than half of our 'plastic' world. They are economic to produce, the scale of production is enormous and offer security of supply along with diversification in hundreds of different grades. But it is not just a matter of quantity that underlies their popularity. Quality is also a key component.

The properties of polyethylene and polypropylene make them exceptionally well suited for the processing to all kinds of packaging, from wraps to bags and from crates to bottles and vessels. The intrinsic absence of food-contamination risks plus their substantial strength makes them safe in many important respects.

Nowadays, polyethylene and polypropylene are increasingly becoming a rival to engineering plastics and, to a lesser extent, classical elastomers. This is primarily attributable to their flexibility. The stiffness and toughness of polyethylene and polypropylene can be varied using modern catalysts or developing blends and making compounds with fillers, fibres and nano-particles, and thus intrinsically improve the polyethylene and polypropylene.

These materials are tending to replace the heavier steel or aluminium used in car construction to dramatically reduce the weight of the car and improving its fuel economy. Polyethylene, with ultra-high molecular weight, is already well known as the raw material for super strong fibres (Dyneema) and new uses are also being developed in knee and hip prostheses (patented by DPI). The inertness that is so crucial to food-packaging is also a key factor in medical applications. Polyethylene and Polypropylene have found a place in the world of fibres and fabrics. Carpets with a polypropylene underside are quite common, but the carpet's upper side can also be made from it. Further, they are also used in special sportswear, gloves, ropes, woven bags, etc. Not forgetting the special foams, made of low-density polyethylene, used in many cars to make them safe and comfortable.

All of these applications, and more, are made possible by a vast research force around the world working on these materials, leading to more applications, new insights into molecular structures and the kind of properties that may be expected from a variety of processing techniques. A wide variety of technologies produces the different polyethylene and polypropylene, either by catalysis or initiated by radicals. With new catalysts being discovered every year, the production technologies are being steadily modernised. Recently, important progress has been made in the modeling of catalytically active surfaces and catalysts, particularly in the field of metallocenes. The polyethylene and polypropylene industry are now at a crossroads with a revolution directly attributable to these metallocenes. The metallocene constrained geometry catalysts offer the control of the polyolefin structure and molecular weight as never before witnessed. New polymers based on propylene and ethylene are still evolving and sometimes new monomers enter fields where special properties are a must, like optics (polymethylpentene) and special elastomers (copolyethylene/norbornene).

This course is designed to present the structure, morphology, and properties of polyethylene and polypropylene synthesis. It focuses on synthetic advances, the use of additives, polyolefin blends, composites and fibers, and surface treatment, including a discussion of the problem of interfacial and superficial phenomena. The course considers both the primary industrial and more novel routes of synthesis. It examines new additives, including stabilizers, nucleating and clarifying agents, fillers and reinforcements, and coupling agents. It also describes thermodynamic properties of polyethylene and polypropylene solutions, explains functionalized and controlled lifetime polyolefins and more.

The Polyethylene and Polypropylene manufacturing process covered by this course use ethylene and propylene feedstocks from refinery crackers to produce polyethylene or polypropylene. No other feedstocks sources will be discussed.

## Course Objectives

Upon the successful completion of this course, each participant will be able to:

- Apply a comprehensive knowledge and skills in polyethylene & polypropylene manufacturing and troubleshoot manufacturing process
- Characterize and differentiate the mechanical properties of polyethylene & polypropylene
- Discuss the crystallography of polyethylene & polypropylene and describe the structural hierarchy and morphology of single crystals

- Compare the properties of copolymers and blends, and describe the polymer melt processing including its rheological properties and orientation in flowing polymer melts
- Demonstrate familiarity of catalyst technology, additives and the health, safety and environmental concerns related to the manufacturing and processing of polyethylene and polypropylene.

## Exclusive Smart Training Kit - H-STK®


*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.*

## Who Should Attend

This course provides an overview of all significant aspects and considerations of polyethylene and polypropylene manufacturing and process troubleshooting for process, chemical, operation, design and production engineers and technical staff. Further, the course is suitable for environmental, laboratory, R&D and R&T staff including chemists, scientists, analysts, technologist, technicians and environmental professionals.

## Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

## Course Fee

**US$ 5,500** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

## Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

**Course Certificate(s)**
Internationally recognized certificates will be issued to all participants of the course.

**Certificate Accreditations**
Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Association for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

**Course Instructor(s)**

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

**Mr. Mervyn Frampton** is a **Senior Process Engineer** with over **30 years** of industrial experience within the **Oil & Gas**, **Refinery**, **Petrochemical** and **Utilities** industries. His expertise lies extensively in the areas of **Process Troubleshooting**, **Distillation Towers**, **Fundamentals of Distillation** for Engineers, **Distillation** Operation and Troubleshooting, **Advanced Distillation** Troubleshooting, **Distillation** Technology, Vacuum **Distillation**, **Distillation Column** Operation & Control, **Oil Movement** Storage & Troubleshooting, **Process Equipment** Design, **Piping Systems**, Applied **Process Engineering** Elements, **Process Plant** Optimization, **Revamping & Debottlenecking**, **Process Plant** Troubleshooting & Engineering Problem Solving, **Process Plant** Monitoring, **Catalyst** Selection & Production Optimization, Operations Abnormalities & Plant Upset, **Process Plant** Start-up & Commissioning, **Clean Fuel** Technology & Standards, Flare, Blowdown & Pressure Relief Systems, **Oil & Gas Field Commissioning** Techniques, **Pressure Vessel** Operation, **Gas Processing**, **Chemical** Engineering, **Process Reactors** Start-Up & Shutdown, **Gasoline Blending** for Refineries, **Urea Manufacturing** Process Technology, Continuous Catalytic Reformer (**CCR**), **De-Sulfurization** Technology, Advanced Operational & Troubleshooting Skills, Principles of Operations Planning, **Rotating Equipment** Maintenance & Troubleshooting, **Hazardous Waste Management & Pollution Prevention**, **Heat Exchangers & Fired Heaters** Operation & Troubleshooting, **Energy Conservation** Skills, **Catalyst Technology**, **Refinery & Process Industry**, **Chemical Analysis**, **Process Plant**, **Commissioning & Start-Up**, **Alkylation**, **Hydrogenation**, **Dehydrogenation**, **Isomerization**, **Hydrocracking & De-Alkylation**, **Fluidized Catalytic Cracking**, **Catalytic Hydrodesulphuriser**, **Kerosene Hydrotreater**, **Thermal Cracker**, **Catalytic Reforming**, **Polymerization**, **Polyethylene**, **Polypropylene**, Pilot Water Treatment Plant, **Gas Cooling**, **Cooling Water Systems**, Effluent Systems, Material Handling Systems, **Gasifier**, **Gasification**, Coal Feeder System, **Sulphur Extraction Plant**, **Crude Distillation Unit**, **Acid Plant Revamp** and **Crude Pumping**. Further, he is also well-versed in HSE Leadership, Project and Programme Management, Project Coordination, Project Cost & Schedule Monitoring, Control & Analysis, Team Building, Relationship Management, Quality Management, Performance Reporting, Project Change Control, Commercial Awareness and Risk Management.

During his career life, Mr. Frampton held significant positions as the **Site Engineering Manager**, **Senior Project Manager**, **Process Engineering Manager**, **Project Engineering Manager**, **Construction Manager**, **Site Manager**, **Area Manager**, **Procurement Manager**, **Factory Manager**, **Technical Services Manager**, **Senior Project Engineer**, **Process Engineer**, **Project Engineer**, **Assistant Project Manager**, **Handover Coordinator** and **Engineering Coordinator** from various international companies such as the **Fluor Daniel**, **KBR** South Africa, **ESKOM**, MEGAWATT PARK, CHEMEPIC, PDPS, CAKASA, **Worley Parsons**, Lurgi South Africa, **Sasol**, **Foster Wheeler**, **Bosch** & **Associates**, **BCG** Engineering Contractors, Fina Refinery, Sapref Refinery, Secunda Engine Refinery just to name a few.

Mr. Frampton has a **Bachelor's degree** in **Industrial Chemistry** from **The City University** in **London**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management** (**ILM**) and has delivered numerous trainings, courses, workshops, conferences and seminars internationally.

## Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

***Day 1***

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| *0730 – 0800* | *Registration & Coffee* |
| *0800 – 0815* | *Welcome & Introduction* |
| *0815 – 0830* | ***PRE-TEST*** |
| *0830 – 0930* | ***Introduction to Polyolefins***<br>*Polyethylene (HDPE, LDPE, LLDPE, UHMWPE, etc.) • Isotactic Polypropylene • Isotactic Polybutene-I • Isotactic Polymers of Higher Olefins and Poly(4-Methyl Pentene-1) • Ethylene-Propylene • Ziegler–Natta Metallocene Polymerization and Free Radical Polymerization Processes* |
| *0930 – 0945* | *Break* |
| *0945 – 1100* | ***Introduction to Polyolefins (cont'd)***<br>*Polymerization Processes & Stereo-Regularity Control • Syndiotactic Polypropylene • Cyclopolyolefins • New Metallocene Polyolefin Copolymers • Current Production Levels • Bulk Polymer Properties and Chemical Stability* |
| *1100 – 1230* | ***Characterization Methods of Polyethylene & Polypropylene***<br>*Asymmetric Carbon Atoms and Tacticity • Crystallinity • Crystal Structure • Chain Conformation in Crystals* |
| *1230 – 1245* | *Break* |
| *1245 – 1420* | ***Characterization Methods of Polyethylene & Polypropylene (cont'd)***<br>*Molecular Weight Distribution • Orientation • Superstructure* |
| *1420 – 1430* | ***Recap*** |
| *1430* | *Lunch & End of Day One* |

***Day 2***

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| *0730 – 0900* | ***Mechanical Properties of Polyethylene & Polypropylene***<br>*Introduction • Stress and Small Strain Elasticity • Influence of Molecular Weight • Influence of temperature • Influence of Crystallinity and Comparisons to Other Materials* |
| *0900 – 0915* | *Break* |
| *0915 – 1100* | ***Mechanical Properties of Polyethylene & Polypropylene (cont'd)***<br>*Uniaxial Large Strain Behavior • Mechanical Properties of Melt-Spun/Drawn Fibers • High Modulus Polyolefin fibers • Mechanical Properties of Films • Mechanical Property Modification by Copolymerization and Blending* |
| *1100 – 1230* | ***Crystallography of Polyethylene & Polypropylene***<br>*Introduction • Early Investigation of Low Molecular Weight Paraffinic Compounds • Polyethylene • Isotactic Polypropylene • Syndiotactic Polypropylene* |
| *1230 – 1245* | *Break* |
| *1245 – 1420* | ***Single Crystals: Structural Hierarchy and Morphology***<br>*Introduction • Polyethylene • Isotactic Polypropylene • Syndiotactic Polypropylene* |
| *1420 – 1430* | ***Recap*** |
| *1430* | *Lunch & End of Day Two* |

**Day 3**

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| 0730 – 0900 | ***Spherulites and Quiescent Crystallization***<br>*Introduction • Spherulites* |
| 0900 – 0915 | *Break* |
| 0915 – 1100 | ***Spherulites and Quiescent Crystallization (cont'd)***<br>*Quiescent Crystallization Kinetics • Time-Temperature Transformation and Continuous Cooling Transformation Plots* |
| 1100 – 1230 | ***Copolymers and Blends***<br>*Stereoblock Copolymers • Copolymers of Polyethylene* |
| 1230 – 1245 | *Break* |
| 1245 – 1420 | ***Copolymers and Blends (cont'd)***<br>*Copolymers of Polypropylene • Blends* |
| 1420 – 1430 | ***Recap*** |
| 1430 | *Lunch & End of Day Three* |

**Day 4**

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| 0730 – 0900 | ***Polymer Melt Processing, Rheological Properties and Orientation in Flowing Polymer Melts***<br>*Introduction • Polymer Melt Processing Technology • Rheological Properties of Polymer Melts • Effects of Additives • Early Observations of Flow Birefringence* |
| 0900 – 0915 | *Break* |
| 0915 – 1100 | ***Polymer Melt Processing, Rheological Properties and Orientation in Flowing Polymer Melts (cont'd)***<br>*Flow Birefringence and Stress • Stress Optical Coefficients and Molecular Structure • Orientation Factors and Stress Melts • Flow in Dies* |
| 1100 – 1230 | ***Melt Spinning***<br>*Introduction • Melt Spinning Process • Dynamics, Heat Transfer, and Modeling in Melt Spinning • Melt Flow Instabilities* |
| 1230 – 1245 | *Break* |
| 1245 – 1420 | ***Melt Spinning (cont'd)***<br>*Melt Spinning of Virtifying Polyhydrocarbons • Polyethylene • Isotactic Polypropylene • Syndiotactic Polypropylene* |
| 1420 – 1430 | ***Recap*** |
| 1430 | *Lunch & End of Day Four* |

**Day 5**

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| 0730 – 0900 | ***Catalyst Technology***<br>*LDPE & LLDPE Production Process and Technique: Free Radical Polymerization of LDPE, Ziegler-Natta Polymerization of LLDPE • Basic Principles of Metallocene and Single-Site Chemistry and Catalysts • Reaction Mechanisms • Post Metallocene Single-Site Catalysts • Current Problems and Future Trends in Single-Site Catalysis • Competitive Advances in Zeigler-Natta Technology for Polypropylene and Polyethylene* |
| 0900 – 0915 | *Break* |
| 0915 – 1045 | ***Additives***<br>*Antioxidants (AO) • Light Stabilizers • Fillers • Pigments, Colorants and Dyes • Flame Retardants* |
| 1045 – 1200 | ***Additives (cont'd)***<br>*Lubricants and Other Additives • Some Other Important Additives • Important Considerations • Analysis & Spectrometric Methods* |
| 1200 – 1215 | *Break* |

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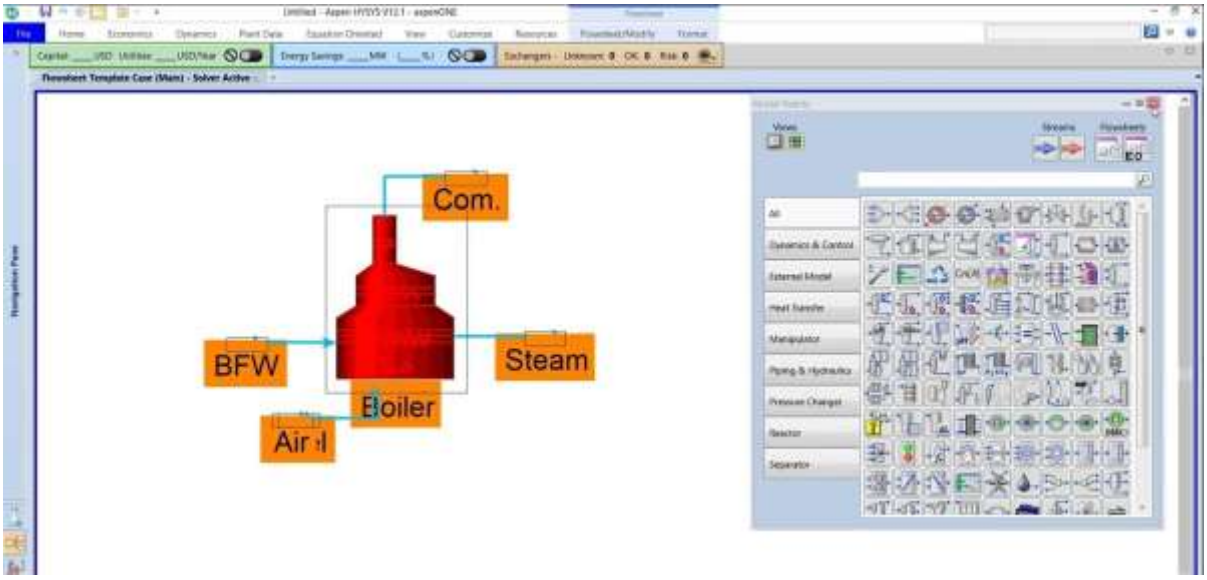
| *1215 – 1345* | ***Health, Safety and Environmental Concerns (HSE)***<br>*Safety Procedures • Environmental Impact • Halogenated vs. Non-Halogenated Flame Retardants • Recycling* |
| *1345 – 1400* | ***Course Conclusion*** |
| *1400 – 1415* | ***POST-TEST*** |
| *1415 – 1430* | *Presentation of Course Certificates* |
| *1430* | *Lunch & End of Course* |

**Simulator (Hands-on Practical Sessions)**

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art "ASPEN HYSYS" simulator.




**ASPEN HYSYS V12.1 Simulator**

**Course Coordinator**

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org