COURSE OVERVIEW PE1058
Physical Testing for PVC Resin Product

Course Title
Physical Testing for PVC Resin Product

Course Date/Venue
June 15-19, 2025/Meeting Plus 9, City Centre Rotana, Doha, Qatar

Course Reference
PE1058

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

Course Description

This practical and highly-interactive course includes real-life case studies where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to provide participants with a detailed and advanced overview on. It covers the PVC resin, types of PVC, importance of physical testing in PVC includes the standards and testing guidelines, sample preparation for testing and laboratory safety and best practices; the visual and basic physical properties, tensile strength and elongation (ASTM D638 / ISO 527), flexural strength and modulus (ASTM D790), impact strength – notched Izod/Charpy (ASTM D256 / ISO 179) and hardness testing (ASTM D2240 – Shore D); the compression and tear testing and vicat softening point (ASTM D1525 / ISO 306); and the heat deflection temperature (HDT – ASTM D648).

During this interactive course, participants will learn the thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), melt flow index and fusion time and specific gravity and density (ASTM D792); the flammability and smoke density, water absorption and moisture content, chemical resistance testing and weathering and UV resistance; the field versus lab performance correlation and statistical quality control (SQC) and test method validation and repeatability; and the quality assurance documentation, audits and compliance and lab best practices and troubleshooting.

Course Objectives

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

- Apply and gain an in-depth knowledge in physical testing for PVC resin product
- Discuss PVC resin, types of PVC, importance of physical testing in PVC includes the standards and testing guidelines, sample preparation for testing and laboratory safety and best practices
- Explain visual and basic physical properties, tensile strength and elongation (ASTM D638 / ISO 527), flexural strength and modulus (ASTM D790), impact strength – notched Izod/Charpy (ASTM D256 / ISO 179) and hardness testing (ASTM D2240 – Shore D)
- Perform compression and tear testing and discuss vicat softening point (ASTM D1525 / ISO 306) and heat deflection temperature (HDT – ASTM D648)
- Determine thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), melt flow index and fusion time and specific gravity and density (ASTM D792)
- Identify flammability and smoke density, water absorption and moisture content, chemical resistance testing and weathering and UV resistance
- Differentiate field versus lab performance correlation and discuss statistical quality control (SQC) and test method validation and repeatability
- Perform quality assurance documentation, audits and compliance and lab best practices and troubleshooting

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 conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of physical testing for PVC resin product for process engineers and production supervisors, compliance and regulatory affairs specialists, laboratory technicians and analysts and other technical staff.

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 completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- 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.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors 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 Accreditors 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.

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:

Dr. Pete Ludovice, PhD, BSc, is a **Senior Chemical Engineer** with over **25 years** of extensive experience in **PVC** Pipe Production, **PVC** Manufacturing, **Polymerization** Process Control & Optimization, **Plastics/Rubber Additives**, **Thermoplastics Processing**, **Plastic Materials**, **Polymer Science** and **Polyolefin** (**Polyethylene & Polypropylene**) **Engineering**. Further, he is also well-versed in **Chemical & Biomolecular Engineering**, **Bioengineering**, **Water Distribution System**, **Water Injection Treatment** and **Water Treatment Technology**. He is currently the **Senior Professor** of **Chemical & Biomolecular Engineering** in **Georgia Institute of Technology**, **USA** wherein he has designed numerous courses on various aspects of **polymer science** and **chemical engineering** that include **Applied Molecular Modelling**, **Numerical Modelling** of **Process Engineering**, and **Chemical Processes** using **Molecular Modelling** to characterize **Polymer Behaviour** and **Methods** for **Technical Innovation.**

Dr. Ludovice's research interests include **structure-property relationships** in **polymer materials** including a variety of polymers from basic vinyl polymers to high performance polymer and biological polymers. His researches have been funded by various industries and the **United States National Science Foundation**, the **Department of Energy**, the **Whitaker Foundation** and the **Office of Naval Research**. Further, he has gained his extensive experience through his prior challenging positions such as the **PVC Pipe Production Manager** of **Cresline Plastic Pipe Co**., **Polymer Product Manager** of **Molecular Simulations Inc**., a **Senior Scientist** for **NASA – Ames Research Center** (**USA**) and the **IBM – Almaden Research Center** (**USA**), a **Research Associate** for the **Institut für Polymere** at the **Eidgenössische Technische Hochschule** in **Zürich**, **Switzerland** and a **Principal Investigator** for 40 diverse international agencies.

Dr. Ludovice holds **PhD** and **Bachelor** degrees in **Chemical Engineering** from the **Massachusetts Institute of Technology**, **USA** and the **University of Illinois**, **USA** respectively. Further, he is a **Certified Instructor/Trainer** and an active member of the American Institute of Chemical Engineers (**AIChE**), Society of Plastics Engineers (**SPE**), Materials Research Society and the American Chemical Society. Moreover, he has published **numerous books** and **papers** circulated **internationally** and **delivered technical presentations** and **seminars** in several **international conferences**. He was also one of the inventors of the "**Self-Expanding Intraluminal Composite Prosthesis**" and the "**Pore-Forming Agents to Enhance Transdermal Delivery of Biological Agents**". Amongst all these achievements, he was **honoured** with **various awards** such as the "**Outstanding PhD Thesis Award**" by Georgia Institute of Technology, the "**Outstanding Professor of the Year**" by AIChE and the "**Sherwin Williams Award in Polymer Science**" by the American Chemical Society.

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$ 6,000 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to PVC Resin*** *Types of PVC: Suspension, Emulsion, Bulk • K-Value & Polymerization Degree • Additives & Compound Formulation • Applications of Rigid & Flexible PVC*
0930 – 0945	*Break*
0945 – 1040	***Importance of Physical Testing in PVC*** *Ensuring Compliance with Specifications • Supporting Product Development • Identifying Processing Defects • Customer Requirement Validation*
1040 – 1135	***Standards & Testing Guidelines*** *Overview of ASTM D1784, ISO 1163 • Sampling Methods for PVC Powder & Compound • Calibration & Traceability of Testing Instruments • Role of SOPs & QA Systems*
1135 - 1230	***Sample Preparation for Testing*** *Powder Conditioning & Sieving • Compression Molding for Test Specimens • Cooling & Conditioning Protocols • Preventing Contamination & Deformation*
1230 – 1245	*Break*
1245 – 1335	***Laboratory Safety & Best Practices*** *Handling PVC Powder & Additives Safely • Ventilation, PPE & Fume Management • Electrical & Mechanical Safety • Storage of Chemicals & Test Samples*

1335 - 1420	***Visual & Basic Physical Properties*** *Color & Appearance Grading • Bulk Density & Tapped Density • Particle Size Distribution (Sieve Analysis) • Apparent Density & Flowability*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Tensile Strength & Elongation (ASTM D638 / ISO 527)*** *Equipment & Test Setup • Specimen Geometry & Clamping • Test Speed, Strain Rate & Gauge Length • Calculating Tensile Modulus & Break Elongation*
0830 – 0900	***Flexural Strength & Modulus (ASTM D790)*** *Three-Point versus Four-Point Bending • Support Span & Specimen Dimensions • Test Rate & Deflection Calculations • Interpreting Yield versus Break Failure*
0900 – 0915	*Break*
0915 – 1100	***Impact Strength – Notched Izod/Charpy (ASTM D256 / ISO 179)*** *Test Principles & Specimen Notching • Conditioning & Temperature Sensitivity • Test Execution & Energy Calculation • Fracture Mode Analysis*
1100 – 1230	***Hardness Testing (ASTM D2240 – Shore D)*** *Durometer Type & Calibration • Test Points & Specimen Thickness • Repeatability & Standard Deviation • Differences in Rigid versus Flexible PVC*
1230 – 1245	*Break*
1245 – 1335	***Compression & Tear Testing*** *Compressive Strength Test Setup • Tear Resistance of Films & Sheets • Role in Pipe & Gasket Evaluation • Crack Propagation Observation*
1335 - 1420	***Case Study & Data Interpretation*** *Example: Comparison of Two PVC Grades • Graph Plotting: Stress-Strain Curves • Tolerance Limits & QC Acceptance • Troubleshooting Abnormal Results*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Vicat Softening Point (ASTM D1525 / ISO 306)*** *Principles & Equipment • Load Selection (B50, A120) • Heating Rate & Penetration Depth • Application Relevance in Pipe & Profile*
0830 – 0900	***Heat Deflection Temperature (HDT – ASTM D648)*** *Deflection versus Load Testing Principle • Sample Preparation & Conditioning • Test Fixtures & Oil Bath Calibration • HDT versus Vicat: Differences & Selection*
0900 – 0915	*Break*
0915 – 1100	***Thermogravimetric Analysis (TGA)*** *Decomposition Profile of PVC • Heating Rate & Mass Loss Curve • Identifying Filler & Plasticizer Content • PVC Degradation Behavior*

1100 – 1230	***Differential Scanning Calorimetry (DSC)*** *Tg (Glass Transition) & Melting Points • PVC Fusion & Crystallization Peaks • Use of DSC in Processing Window • Additive Effect on Thermal Profile*
1230 – 1245	*Break*
1245 – 1335	***Melt Flow Index & Fusion Time*** *MFI for Flexible PVC (ASTM D1238) • Fusion Behavior Using Torque Rheometer • Gelation Time & Plastograph Curves • Impact on Extrusion & Molding*
1335 - 1420	***Practical Lab Session*** *Conduct Vicat & HDT Tests • Set Up & Run TGA/DSC for a PVC Sample • Plotting Curves & Identifying Peak Shifts • Interpreting Effects of Formulation*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

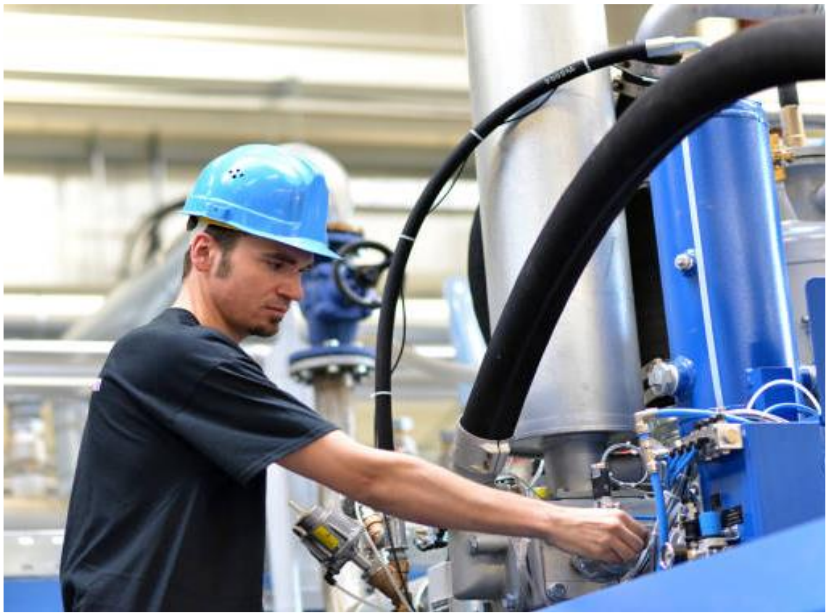
0730 – 0830	***Specific Gravity & Density (ASTM D792)*** *Floating & Immersion Methods • Importance in Formulation Adjustment • Differences in Filled versus Unfilled PVC • Standard Test Media & Temperatures*
0830 – 0930	***Flammability & Smoke Density*** *UL 94 Vertical & Horizontal Burn Tests • LOI (Limited Oxygen Index – ASTM D2863) • Smoke Density Chamber Setup • Role of Flame Retardants & Fillers*
0930 – 0945	*Break*
0945 – 1100	***Water Absorption & Moisture Content*** *ASTM D570 Immersion Test • Gravimetric Moisture Balance • Desiccation & Conditioning Effects • Impact on Electrical & Mechanical Performance*
1100 – 1215	***Chemical Resistance Testing*** *Acid, Alkali, Solvent Resistance • Staining, Swelling, Discoloration Evaluation • Storage Tank & Pipe Compatibility • Long-Term Immersion Test Protocol*
1215 – 1230	*Break*
1245 – 1335	***Weathering & UV Resistance*** *QUV Accelerated Weathering • Yellowness Index & Gloss Retention • Surface Cracking, Chalking Observation • Stabilizer Evaluation*
1335 - 1420	***Field versus Lab Performance Correlation*** *Real-World Failures & Lab Test Replication • Field Sample Comparison with Standards • Adjusting Lab Methods for Product Conditions • Reliability Forecasting*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

0730 – 0830	***Statistical Quality Control (SQC)*** *Use of Control Charts & Trend Analysis • Cp, Cpk & Process Capability for PVC • Sampling Plans (AQL, MIL-STD-105) • Detecting Out-of-Control Conditions*
0830 – 0930	***Test Method Validation & Repeatability*** *Precision, Bias & Reproducibility • Gage R&R & Inter-Laboratory Studies • Root Causes of Variability • Cross-Checks with Alternative Methods*
0930 – 0945	*Break*
0945 – 1045	***Quality Assurance Documentation*** *Test Report Structure & Traceability • Certificate of Analysis (CoA) Generation • Lab Notebook versus Digital LIMS Records • Regulatory Requirements for Recordkeeping*
1045 – 1215	***Audits & Compliance*** *ISO 17025 & Lab Accreditation • Internal versus External Audit Readiness • Instrument Calibration & Traceability • Corrective & Preventive Action (CAPA)*
1215 – 1230	*Break*
1230 – 1345	***Lab Best Practices & Troubleshooting*** *Equipment Cleaning & Maintenance • Error Logs & Procedural Adherence • Continuous Improvement in Testing • Staff Competency & Training*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-



Course Coordinator

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