

# CERTIFICATE OF PARTICIPATION

The scientific and organizing committees attribute this attendance certificate to:

**Oualid DAIRI**

For his participation in the 3rd Edition of the International Conference on Metrology, Industrial Control, and Innovation (ICMICI 2025), held on October 28–29, 2025, at Setif 1 University Ferhat Abbas, Algeria, with a Poster presentation entitled:

**« Influence of Vickers Indentation-Induced Defects on the Mechanical Behavior and Reliability of Float Glass under Biaxial Flexure in Humid Conditions »**

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## International Conference on Metrology, Industrial Control and Innovation (ICMICI 2025)

# Influence of Vickers Indentation-Induced Defects on the Mechanical Behavior and Reliability of Float Glass under Biaxial Flexure in Humid Conditions

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### Abstract

The mechanical strength of float glass is critically influenced by surface defects and environmental conditions like humidity. This study investigates the biaxial flexural strength of Mediterranean Float Glass (MFG) under controlled humid conditions to quantify these effects. We introduced Vickers indentation defects using two loads (1 N and 10 N) at three distances (2 mm, 10 mm, 18 mm) from the high-stress contact point of a ring-on-ring (ROR) bending device. Fifteen samples (50×50 mm<sup>2</sup>) were tested in distilled water at a constant loading rate of 0.3 mm/min. The Weibull statistical distribution was used to analyze the relationship between defect characteristics (load, position) and the glass's mechanical reliability. Key parameters like Weibull modulus ( $\beta$ ), scale parameter ( $\eta$ ), and median time to failure were determined. This research provides crucial insights for predicting glass performance and optimizing material design for applications in wet environments by establishing a clear link between controlled defects, environmental factors, and structural integrity.

### introduction

Glass is a versatile material but its mechanical performance is highly sensitive to surface flaws and environmental factors.

Surface defects (e.g., microcracks from handling) act as stress concentrators, significantly reducing strength and leading to unpredictable failure.

Water (humidity) exacerbates this issue through stress corrosion, a process where water molecules at the crack tip accelerate crack propagation, undermining the glass's structural integrity.

While the individual effects of defects and water are known, there is a lack of comprehensive research on how Vickers indentation-induced defects specifically influence the biaxial flexural strength of float glass in wet environments.

This study aims to fill this gap by systematically analyzing the combined effect of defect severity (load), defect location (distance from stress), and a humid environment on the reliability of float glass.

### Methods / Experimental Procedure

Controlled Vickers indentations were made on the sample's tensile side.

Two Loads: 1 N (minor flaw) and 10 N (severe flaw). Three Distances: 2 mm, 10 mm, and 18 mm from the center of the loading ring

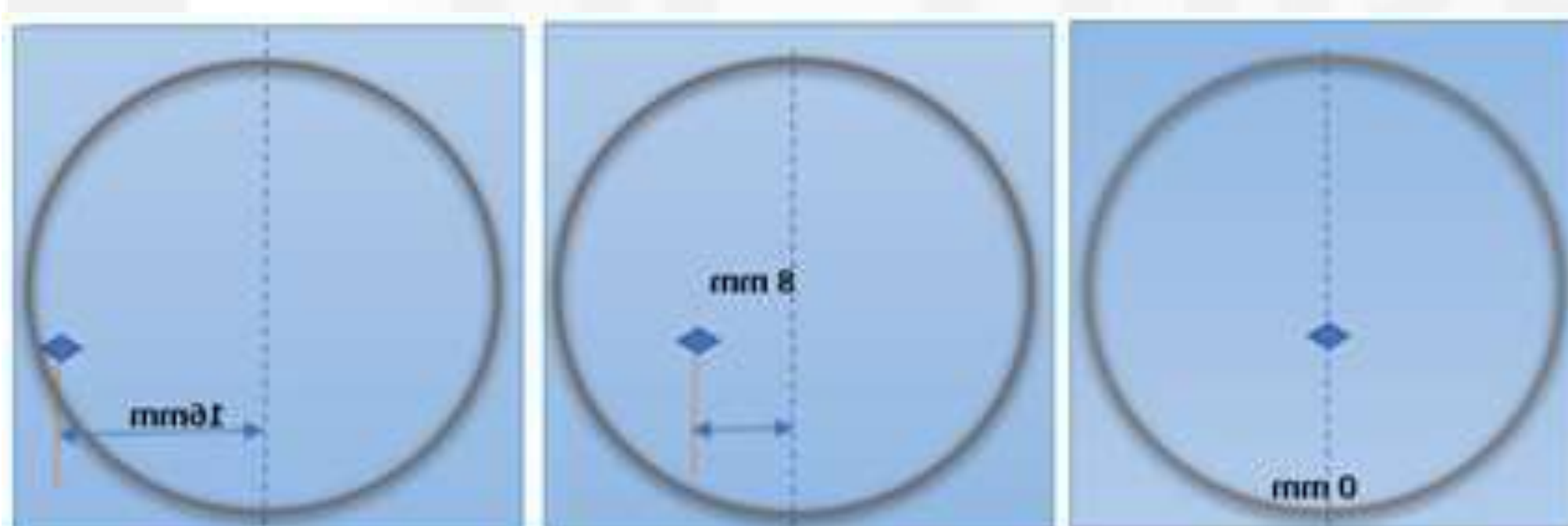


Figure 1: different positions of the indentations in relation to the ring limit

Ring-on-Ring (ROR) Biaxial Flexural Test was performed to determine intrinsic strength, avoiding edge effects.

All tests were conducted submerged in distilled water to simulate a humid environment.

Loading rate was constant at 0.3 mm/min.

Weibull Statistical Analysis was used to model the probability of failure.

Shape Parameter ( $\beta$  or  $m$ ): Weibull modulus, indicates the variability of flaw sizes (higher  $\beta$  = less variability).

Scale Parameter ( $\eta$  or  $\sigma_0$ ): Characteristic strength, related to the mean strength.

Median Time to Failure (MTTF): The time by which 50% of the samples are expected to fail

### Results

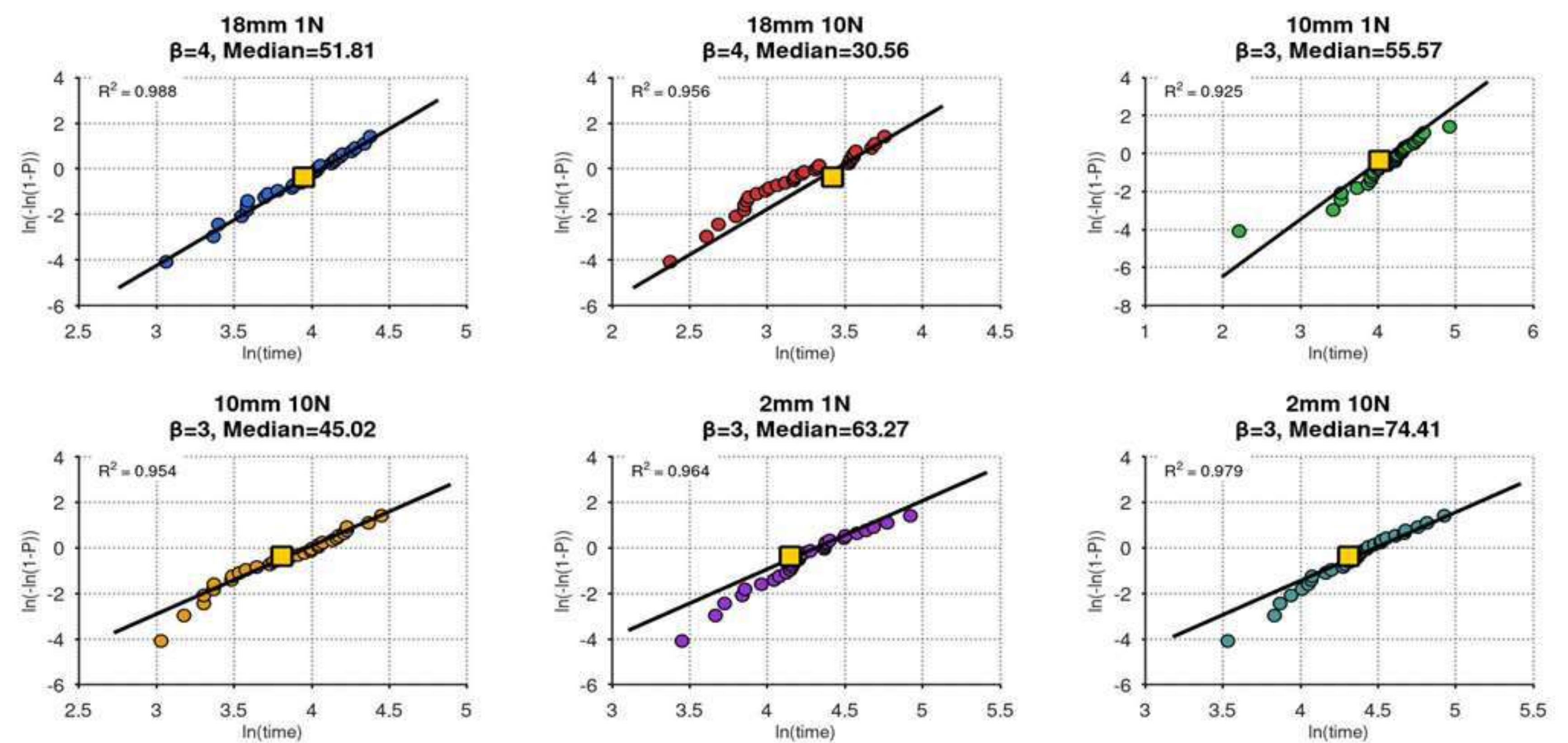


Figure 2: lognormal distribution for different distances and applied loads

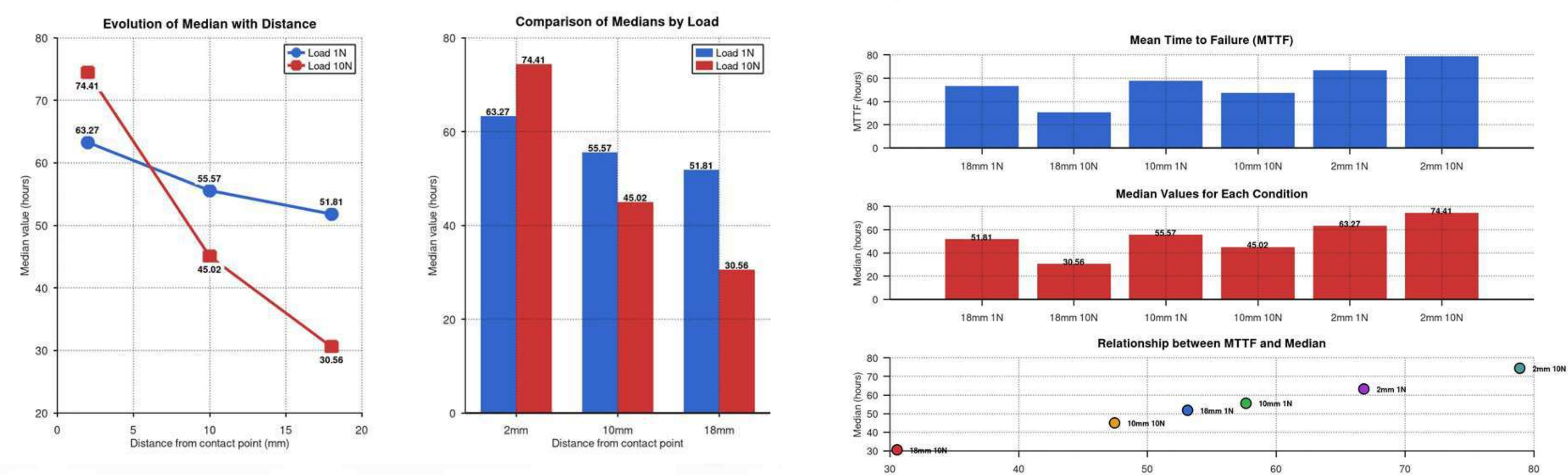


Figure 3: Evolution of Median Values as a Function of Indentation Defect Distance and Applied Load in Ring-on-Ring Bending Tests

Figure 4: Analysis of Mean Time to Failure (MTTF) and Median Values for Ring-on-Ring Bending Tests Under Various Load and Distance Conditions

### Conclusion

This study successfully demonstrates that Vickers indentation-induced defects significantly compromise the mechanical integrity of float glass in humid environments.

Higher indentation loads (10 N) create more critical flaws that consistently reduce the glass's lifespan (MTTF) and characteristic strength ( $\eta$ ).

Defect location is critical: flaws near high-stress zones drastically increase the probability of failure, as confirmed by a lower Weibull modulus ( $\beta$ ).

The presence of water acts as an accelerator, exacerbating crack propagation and undermining the material's strength.

Practical Implication: For applications in humid or wet conditions, it is crucial to minimize surface defects, especially in areas subjected to high mechanical stress.

The Weibull analysis provides a robust framework for predicting glass reliability and optimizing quality control processes based on flaw characteristics and environmental exposure.





# 3<sup>rd</sup>

## International Conference on Metrology, Industrial Control and Innovation

الملتقى الدولي الثالث في علم القياس، الرقابة الصناعية والابتكار



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**SETIF, 28 & 29 October 2025**

**At the Auditorium Mouloud Kacem Nait  
Belkacem, El Bez Campus**



## October 28, 2025

08:00 – 09:30	<b>Registration</b>
09:30 – 10:00	<b>Welcome Coffee</b>
10:00 – 10:30	<b>Opening Ceremony</b> <ul style="list-style-type: none"><li>• Welcome address by the conference chairman</li><li>• Opening of the conference by the Rector of Setif 1 University</li></ul>
10:30 – 11:15	<b>Plenary Session 1</b>  <b>Chairs: Dr. F. Roumili, Prof. Krishok</b>  <b>Plenary Speaker / Mr. A. kolaia</b> <i>Bureau Veritas Exploitation, Direction Technique Performance HSE, France</i> Title of talk: <i>Quantification du Methane par drone   Méthode (Masse-Balance) site level   Mesurage et Incertitude</i>
11:15 – 12:030	<b>Plenary Session 2</b>  <b>Chairs: Prof. F.Benali, Dr. V.Cherkasova</b>  <b>Plenary Speaker / Prof. Tarek khenoufi</b> <i>ANPT مدير الحاضنة الجهوية برج بوعريريج الوكالة الوطنية لترقية الحضائر التكنولوجية وتطويرها</i> Title of talk: <i>(البيئة الاقتصادية آفاق الابتكار 2030) Ecosystem and innovation Horizons 2030</i>
12:00 – 12:30	<b>Poster Session 1&amp; (Workshop for master students 1 + Workshop innovation (Prof. Benali))</b>
12:30 – 14:00	<b>Lunch Break</b>
14:00 – 14:45	<b>Plenary Session 3</b>  <b>Chairs: Prof. N. Khennafi-Benghalem, Prof. Jörg Pezoldt</b>  <b>Plenary Speaker / Dr. Valeriya Cherkasova</b> <i>Institute of Process Measurement and Sensor Technology, Technische Universität Ilmenau, Germany.</i> Title of talk: <i>Bridging the Gap: Traceable Small Force Metrology Across Nine Orders of Magnitude</i>
<b><u>Oral Session 1</u></b>	
<b>Chairs: Dr. Mezaache, Prof. Benia</b>	
14:45 – 15:00	<b>Speaker / Nafissa KHENNAFI-BENGHALEM</b> <i>Department of Optics, Laboratory of Mechatronics, Ferhat Abbas university, setif</i> Title of talk: <i>L'unité de masse de la matérialisation à la physique quantique : le petit h successeur du grand K</i>
15:00 – 15:15	<b>Speaker / Nour el houda DADOUCHE</b> <i>Department of Optics, Laboratory of Mechatronics, Ferhat Abbas university, setif</i> Title of talk: <i>Ensuring Measurement Reliability with a Fractal Microwave Liquid Sensor</i>
15:15 – 15:30	<b>Speaker / Tarek BENTAHAR</b> <i>Higher National School of Renewable Energies, Environment &amp; Sustainable Development Batna, Algeria</i> Title of talk: <i>InSAR-Based Ground Deformation Monitoring: Uncertainty Analysis and Public Safety Applications</i>
15:30 – 15:45	<b>Speaker / Chahrazad ADICHE</b> <i>Faculty of Mathematics, LaROMaD (USTHB) Algiers 16000, Algeria</i> Title of talk: <i>MILP-Based Metrological Calibration Optimization for Cyber-Physical Systems and IoT in Industry 4.0</i>
15:45 – 16:15	<b>Coffee Break &amp; Poster Session 2</b>

Oral Session 2 and Workshop for master students 2

**Chairs: Prof. Mokhnache, Dr. Slimi**

16:15 – 16:30	<b>Speaker / Kadi Mohamed</b> <i>Higher National School of Renewable Energies, Algiers 16000, Algeria</i> Title of talk: Metrological Evaluation of a low-Cost Arduino Based Radar System for Distance Measurement
16:30 – 16:45	<b>Speaker / Latifa haderbache</b> <i>Institute of applied sciences and techniques ISTA boumerdes, UR-MPE M'hamed Bougara University Boumerdes 35000, Algeria</i> Title of talk: Estimating the periodicity of metrological confirmations of glass capillary viscosimeters using criticality- based approach
16:45 – 17:00	<b>Speaker / Vitalii Shmagun</b> <i>Institute of Process Measurement and Sensor Technology, Technical University of Ilmenau, Ehrenbergstraße 29, 98693 Ilmenau, Germany</i> Title of talk: Compact differential interferometric sensor with picometer resolution
17:00 – 17:15	<b>Speaker / Richard Draxler</b> <i>Technical University of Ilmenau, Ehrenbergstraße 29, 98693 Ilmenau, Germany</i> Title of talk: Impact of makerspaces on local innovation: From community projects to startups

## October 29, 2025

08:30 – 09:15

*Plenary Session 4*

**Chairs : Prof. Meguellati, Pr. El Alimi**

**Plenary Speaker / Jörg Pezoldt<sup>1</sup>**

*FG Nanotechnologie, Institut für Mikro- und Nanoelektronik and Institut für Mikro- und Nanotechnologien MacroNano® and Institut für Werkstofftechnik, Gustav-Kirchhoffstrasse 7, Ilmenau, Germany*

Title of talk: Electron beam lithography: Physical and technical fundamentals, metrological aspects of proximity correction and applications

09:15 – 10:00

*Plenary Session 5*

**Chairs: Prof. A. Manallah, Dr.H. Laouamri**

**Plenary Speaker / Prof. Souheil El Alimi**

*University of Monastir, National Engineering School of Monastir, Laboratory of Thermal and Energy Systems Studies (LESTE), Monastir, Tunisia*

Title of talk: Green Hydrogen: Opportunities and Challenges for the MENA Region

10:00 – 10:30

*Coffee Break & Poster Session 3*

*Oral Session 4*

**Chairs: Prof. A.Chorfa, Prof. S. Leclerc**

10:30 – 10:45

**Speaker / Ghodbane Hassina**

*LEREESI Laboratory, HNS-RE2SD, Batna, Algeria*

Title of talk: Optimizing Combustion Strategies to Maximize Efficiency in Hydrogen Internal Combustion Engines

10:45 – 11:00

**Speaker / Nadia ILES**

*Laboratory of Thin Films Physics and Materials for Electronics, Oran 1 university Ahmed Ben Bella*

Title of talk: Casien- Anthocyanins films as smart biosensors

11:00 – 11:15

**Speaker / Leonidas Perez**

*Department of Mechanics, Ilmenau University of Technology, Germany*

Title of talk: Semi-active optical RFID microsensor for amplifying low-frequency signals with high resolution based on an opto-fluidic switch with a flow-focusing system.

11:15 – 11:30

**Speaker / Hacen Edhahri**

*National Engineering of Monastir, Laboratory of Thermal and Energy Systems Studies*

*University of Monastir, Ibn Eljazzar Street, 5019 Monastir, Tunisia*

Title of talk: Metrology in Thermal Energy storage

11:30 – 12:15

*Plenary Session 6*

**Chairs: Prof. Ferria, Dr. Assia Demagh**

**Plenary Speaker / Prof. Sylvain Lecler**

*INSA Strasbourg, France*

Title of talk: Photonic jet and super-resolution at mesoscale

12:15 – 12:45

**Closing ceremony**

12:45 – 14:00

*Lunch Break*

**Poster session 1: (12:00 – 12:30) (Chairs: Dr. B. MERTANI, Dr. D. ISSAAD)**

Poster ID	AUTHOR	TITLE
P.01	<b>Hind LAOUAMRI</b>	Inspection on surface defects using shadow Moiré technique
P.02	<b>Amira DIAFAT</b>	Uncertainty budget development for optical CMMs measurements: application to external metric threads
P.03	<b>Abdelhak ELMACHI</b>	STARTUP : RECTENNAS RF FLEXIBLES & IMPRIMEES EN 3D POUR L'ALIMENTATION SANS FIL.
P.04	<b>Marwa BARBERIS</b>	Flexural testing of composite materials: Al-Al sandwich
P.05	<b>Meriem MESSAGIER</b>	The phenomenon of interference in white light produced by thin layers stacked in a mineral material
P.06	<b>Oussama NAAMOUNE</b>	Edge-enabled CNN Framework for Real-Time Bearing Fault Diagnosis Industrial IoT
P.07	<b>Kahina TAIEB</b>	Ultra-Precision Machining and Optical Characterization of BGO Single Crystals
P.08	<b>Hanine HADFANI</b>	A Study on Optimizing Temperature Measurement Accuracy in Natural Gas Pipelines: Sensor Efficiency and Environmental Factors
P.09	<b>Oualid DAIRI</b>	Influence of Vickers Indentation-Induced Defects on the Mechanical Behavior and Reliability of Float Glass under Biaxial Flexure in Humid Conditions
P.10	<b>Nora Rezaiguia</b>	Fuzzy MPPT Control for Photovoltaic Water Pumping System under Variable Environmental Conditions
P.11	<b>Lynda Ouzane</b>	Design and simulation of a smart energy meter for real time monitoring
P.12	<b>Soumia Hamdani</b>	Atomistic Measurement of Contact Area and Hardness in $\alpha$ -Iron Using Nano-Indentation via Molecular Dynamics Simulation
P.13	<b>Issam BOUHABILA</b>	Calibration system of Phasor Measurement Units
P.14	<b>Saoussen CHABOU</b>	Evaluating structured Gaussian beam propagation using the M <sup>2</sup> beam quality metric
P.15	<b>Tarek bouguettaya</b>	Harris Hawks Optimization Algorithm for Enhancing Random Forest Performance in Transformer Fault Classification
P.16	<b>Ikram Khellaf</b>	Metrological Characterization of Optical Surface Finishing Using Alumina and Cerium Oxide Bonded Tools
P.17	<b>Amel BAKHOUCHE</b>	Application of Artificial Intelligence in Metrology with Python : Analysis, Prediction, and Automation
P.18	<b>Ines MAMMERINE</b>	Investigation Of The Temperature-Dependent Spectral Transmittance Of Vanadium Oxide Thin Films Deposited By Thermal Evaporation

**Poster session 2: (15:45 – 16:15) (Chairs: Pr. F. SEMCHEDDINE, Dr. A. OURAHMOUN)**

Poster ID	AUTHOR	TITLE
P.19	<b>Habia Mohamed Ilyes</b>	Advanced SPR Techniques Measurement: Enhancing Sensitivity and Accuracy in Analyte Detection using ZnO
P.20	<b>Amina NEZZAR</b>	Thermal Response Study of an Optical Fiber Sensor Using COMSOL Multiphysics
P.21	<b>Sabira MOUHOUBI</b>	Evaluation of the cementation of low alloy steels by optical microscopy and micro-indentation
P.22	<b>Fatine BOUGHAZIOU</b>	Localisation and sizing of particles in off-axis digital holography using two views (direct and orthogonal)
P.23	<b>Ahlem BENSMARA</b>	Grid Connected DFIG-Based Wind System Using Vector Control Technique
P.24	<b>Mohammed ADAIKA</b>	Enhancing Grid-Connected Photovoltaic Systems through Fault Diagnosis
P.25	<b>Sabah CHERIF</b>	Numerical and Experimental Study of the Diffraction of a Gaussian Beam Modulated by Phase Slits
P.26	<b>Abdelbaki CHEROUANA</b>	Modeling of a photonic sensor based on a strip waveguide using the effective index method
P.27	<b>Abdelbaki CHEROUANA</b>	Modeling of a photonic sensor based on a strip waveguide using the effective index method
P.28	<b>Cherifa SOUID</b>	Quantitative Assessment of Contact Lens Surface Properties
P.29	<b>Fatiha KERAGHEL</b>	Measurement and control of friction in Bronze Cu8%Sn and Steel Z200C13 couples
P.30	<b>Loghrab Mohamed</b>	Fiber-Optic Fabry–Pérot Interferometric Sensor Using a PMMA Microlens for Temperature and Pressure Sensing
P.31	<b>Loghrab Mohamed</b>	Fiber-Optic Fabry–Pérot Interferometric Sensor Using a PMMA Microlens for Temperature and Pressure Sensing
P.32	<b>Zaidi Dallel</b>	Cladless Single-Mode Optical Fiber Sensor for Cd Detection
P.33	<b>Manal SAYAD</b>	Acousto-Optic Technique for High-Precision Measurement of Sound Velocity in Liquids
P.34	<b>Amani SOUIOUE</b>	Farmify : Smart Surveillance and Diagnostic System for Precision Farming.
P.35	<b>Issam BOUHABILA</b>	Calibration system of Phasor Measurement Units
P.36	<b>Amani Souiouet</b>	Farmify: Smart Surveillance and Diagnostic System for Precision Farming

**Poster session 3: (10h30 -11h15) (Chairs: Dr. B. MERTANI, Dr. D. ISSAAD)**

Poster ID	AUTHOR	TITLE
P.37	<b>Mouatez Billah AMRI</b>	Smart Helmet: Enhancing Rider Safety through Impact Detection and Automated Emergency Response
P.38	<b>Abla guechi</b>	Numerical Simulation of Perovskite Solar Cells Using SCAPS-1D
P.39	<b>Boultif Ayoub</b>	Anti-Theft Security System
P.40	<b>Kosai Zouaoui</b>	Arduino-Based Real-Time Voltage and Current Data Acquisition System for Renewable Energy Applications.
P.41	<b>Massinissa TAYEBI</b>	Sensor Network for Optimizing Wind Turbine Performance
P.42	<b>Maissoune KIALA</b>	Développement d'un filetage premium basé sur l'optimisation et la digitalisation de la métrologie dimensionnelle
P.43	<b>Rouag Souheila et Zouaoui Hadil</b>	Real-Time Medical Monitoring Using Multiple Sensors and Wireless Communication
P.44	<b>Zouaoui hadil rouag souheila</b>	Real-Time Medical Monitoring Using Multiple Sensors and Wireless Communication
P.45	<b>Djouher MALLEK- BOURAS</b>	Soliton Waves: Application to the Dynamics of High-Grade Gliomas
P.46	<b>ZEGHBANE Moncef</b>	An Automatic Roof with Water Sensor in Modern Applications
P.47	<b>MASSINISSA Tayebi</b>	Intelligent Sensor Network for Optimizing Wind Turbine Performance
P.48	<b>RAMDANI Hidaya Anfal</b>	Smart Home System for Hearing-Impaired Individuals Using Arduino-Based Sensor Integration
P.49	<b>YOUSFI Iyed</b>	Metrological Evaluation of a low-Cost Arduino Based Radar System for Distance Measurement
P.50	<b>Selsabil MEKHACHE</b>	Design and Implementation of a Low-Cost Meteorological Station for Real-Time Environmental Monitoring
P.51	<b>Zaghibane moncef</b>	Automatic roof
P.52	<b>Saouli chiraz</b>	Qualification d'une pièce métallique par la machine à mesurer tridimensionnelle MMT
P.53	<b>Asma ABCHI</b>	Effect of surface quality and morphology coating on optical lenses
P.54	<b>Rahima Meziane</b>	Defect Characterization and Quantification in Transparent Ceramics Using Moiré Interferometry