“Pioneer in Welding Technology and Non-Destructive Testing in Turkey”

Welding Technology and NDT Research/Application Center (WTNDT) takes its legal entity from the Middle East Technical University (METU), and it is directly administered by the Office of the President. WTNDT was founded within the frame of a bilateral project (1988-1996) between the Turkish and German governments. BAM-Berlin, DGCIP, and SLV-München were actively contributed to this project by providing training and sending short- and long-term experts. Since its official establishment in 1991 METU has been making very important contributions to the Turkish industry for training and certification of level 1 and 2 NDT experts, international welding engineers; advisory and testing services to industry, and also for academic research on NDT and welding.

WTNDT Center has been continuing its activities successfully without any interruption since 1988. The director of WTNDT is Prof.Dr. C. Hakan Gür, after the period of the founding director (Prof.Dr. Alpay Ankara, 1988-2007). Since 2007, the premises, laboratories, and equipment of the Center have been renovated and upgraded by using the income of the Center. In 2012, a research and development group was established in order to improve the contribution of METU to the Turkish industry.

WTNDT led the establishment of the Turkish Section of the American Society for NDT, and also the establishment of the Turkish NDT Society.

Memberships: Full Member of IIW (International Institute of Welding).

Activities
- Training of International Welding Engineer (IWE) / Technologist / Specialist / Practitioner
- Training and certification of the welders and welding operators
- NDT training and certification (EN ISO 9712, ASNT SNT-TC-1A): UT, RT, MT, PT, VT, digital radiography
- Mechanical tests and Non-Destructive tests for industry
- Academic research studies, Industrial projects, Failure analysis.

Training and Certification (1988-2022)
- 3,834 participants have attended the NDT courses (5 methods, 3 levels).
- 2,171 international welding engineers and 5,500 welders have been trained and certified.
- WTNDT acted as the recognized ATB and examination center of GSI-SLV Munich. After recognition of Turkish ANB (ANB-TR) by IWE, WTNDT started to give IWE diplomas through ANB-TR in April 2011.

METU Welding and NDT Personnel Certification Center (METU-PCC) acts as an accredited certification body (by Turkish Accreditation Council- TURKAK) according to EN ISO 17024, EN ISO 9712 (NDT operator Levels 1, 2, 3), EN ISO 9606-1 (steel welder), and EN ISO 9606-2 (aluminum welder).

Mechanical Tests
Mechanical tests laboratory has been working under TURKAK accreditation according to EN ISO/IEC 17025, including tensile test (ISO 6892-1, ISO 4136, API 1104, ASME Sec IX, AWS D1.1, AWS D1.5, ASTM A370, ASTM E8), hardness test (ISO 6507-1, ISO 9015-1, ANSI/AWS B4.0, ASTM E384), Charpy impact test (ISO 148-1, ISO 9016, API 1104, ASME Sec IX, AWS D1.1, AWS D1.5, ASTM A370, ASTM E23), bending test (ISO 5173, API 1104, ASME Sec IX, AWS D1.1, AWS D1.5, ASTM A370, ASTM E190), nick-break test (API 1104), macroscopic examinations (ISO 17639, API 1104, ASME Sec IX, AWS D1.1, AWS D1.5, ASTM A340) and CTOD fracture toughness tests (ASTM E1290, ASTM E1820, ISO 15653, ISO 12135).

Projects
Trans Anatolian Pipeline Project (TANAP) is globally the biggest pipeline project for delivery of natural gas from Azerbaijan to Turkey and Europe that is 1850 km and constructed under one management agent. 3 fabrication consortiums with 10 pipe mills, 4 construction consortiums, and several vendors provide services to the project. R&D Division of WTNDT has provided about 90% of the structural integrity and mechanical testing requirements of the project. R&D division has also been involved in fitness for service/ purpose assessments and failure analyses for the last 4 years.

In recent years, the R&D activities have been expanded to include the following areas:
- Analysis of internal stresses, deformation, microstructure, hardness distribution with finite element software (FEA) in welded and heat-treated constructions;
- Determination of fatigue and creep behavior of critical materials used in aerospace and defense industries;
• Production of joint interfaces made of functionally graded materials by additive manufacturing, which aims to increase the creep resistance of high temperature resistant CrMo steels with stainless steels;
• Forging grade wire-arc additive manufacturing (WAAM) production of aerospace stainless steels and Ti-alloys;
• Material characterization of products produced by additive manufacturing techniques (Ti6Al4V, Inconel 718, Maraging Steels) by non-destructive methods.

**Academic Activities**
WTNDT gives laboratory support for the welding and NDT courses in the department of Metallurgical and Materials Engineering.
The number of completed MSc and Ph.D. theses on welding and NDT is about 55; the number of publications in journals and congresses is more than 90.

### Completed MSc. and PhD. Theses

<table>
<thead>
<tr>
<th>Year</th>
<th>Thesis Title</th>
<th>Supervisor</th>
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<tbody>
<tr>
<td>2023</td>
<td>Fracture Toughness and Resistance Properties of Wire Arc Additive Manufactured Duplex Stainless Steel Grade Grade 2509, (co-supervisor: Dr. Koray Yurtuşçu)</td>
<td>R. B. Ersan</td>
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<tr>
<td>2019</td>
<td>Effects of Heat Input and Thermal Cycles to the Fracture Toughness of API 5L Grade X70M Steel Welded by Gas Metal Arc Welding</td>
<td>E. Erol</td>
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<td>2018</td>
<td>Investigating The Fracture Behaviour of X70M Linepipe Steel Girth Weldments via Single Edge Notched Tension and Bend Tests</td>
<td>U. Tosun</td>
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<td>2017</td>
<td>Microstructure Control of AISI 4135 for Optimization of Fatigue and Fracture Performance</td>
<td>B. Özcan</td>
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<td>2016</td>
<td>Determination of Shot Peening Effect on Fatigue Behaviour of AISI 4140 Steel by Non-Destructive Measurement of Surface Residual Stresses</td>
<td>S. Çalışkan</td>
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<td>2015</td>
<td>Non-Destructive Evaluation of Residual Stress State in Carburized AISI/SAE 8620 Steel</td>
<td>T. Kaledi</td>
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<td>2014</td>
<td>Microstructural Characterization of Dual Phase Steels by Using Magnetic Barkhausen Noise Analysis</td>
<td>I. Aydın</td>
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<tr>
<td>2013</td>
<td>Fracture Behaviour Differences of API-5L-X70 Steel which are Joined via Submerged Electrode Arc Welding and Gas Metal Arc Welding</td>
<td>M. Çağrıncı</td>
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<td>2012</td>
<td>Numerical Investigation of Residual Stresses, Distortion and Microstructure Evolution in Multi-Pass Welded Steel Components</td>
<td>N. Garipova (PhD)</td>
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<td>2011</td>
<td>Utilization of Friction Stir Processing to Improve the Mechanical Properties of Gas Metal Arc Welded 5083 Aluminum Alloy Plates</td>
<td>S. Firouzeh</td>
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<td>2010</td>
<td>Nondestructive Monitoring of Variations in Microstructure and Residual Stress in Carburized Steels</td>
<td>H. Hızlı</td>
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<td>2008</td>
<td>Effect of Friction Stir Processing on Fracture Toughness and Crack Growth Behaviour of Fusion Welded 5083 Grade Aluminum Plates</td>
<td>G. Akçay</td>
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<tr>
<td>2007</td>
<td>Effects of Friction Stir Processing on Microstructure and Fatigue Crack Growth Behaviour of Gas Metal Arc Welded Al-Alloy</td>
<td>C. Yazganankan</td>
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<tr>
<td>2006</td>
<td>Investigation of Residual Stresses in the Multi-Pass Welded Steels</td>
<td>M. Çağırıcı</td>
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<td>2005</td>
<td>Microstructural &amp; Mechanical Characterization of Duplex Stainless Steel Grade 2205 Joined by Hybrid Plasma &amp; Gas Metal Arc Welding</td>
<td>B. Tolungücü</td>
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<tr>
<td>2004</td>
<td>Non-Destructive Evaluation of Residual Stresses in the Multi-Pass Steel Weldments</td>
<td>G. Erian</td>
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<td>2003</td>
<td>Effect of welding parameters on the hot cracking behavior of 7039 aluminum - zinc alloy</td>
<td>M. Akkus</td>
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<td>2002</td>
<td>Microstructural / mechanical characterization of MAG welded joint between cast iron &amp; low-C steel</td>
<td>M.T. Ertürk</td>
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<td>2001</td>
<td>Monitoring Variation of Surface Residual Stresses in the Shot-Peened Steel Components by Magnetic Barkhausen Noise Method</td>
<td>S. Savaş</td>
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<td>2000</td>
<td>Determination of Residual Stress State in Steel Weldments</td>
<td>H. I. Yel bay</td>
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<td>1999</td>
<td>Characterization of Ultra-Fine Grained Steel Samples Produced by High Pressure Torsion via Magnetic Barkhausen Noise Analysis</td>
<td>S. Bayramoğlu</td>
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<td>1998</td>
<td>Effect of filler material on hot cracking susceptibility of 5XXX series Al-Mg alloys (PhD)</td>
<td>S. Tırkeş</td>
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<td>1997</td>
<td>Effect of Welding Parameters on the Susceptibility to Hydrogen Cracking in Line Pipe Steels in Sour Environment</td>
<td>O. Yavaş</td>
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<td>1996</td>
<td>Estimation of Heights of Surface Breaking Cracks Using Ultrasonic Timing Methods</td>
<td>E. Öztürk</td>
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<td>1995</td>
<td>Characterization of Steel Microstructures by Magnetic Barkhausen Noise Analysis</td>
<td>K. Davut</td>
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<td>1994</td>
<td>Characterization of Dual Phase Steels by Using Magnetic Barkhausen Noise Analysis</td>
<td>M. Kaplan</td>
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<td>1993</td>
<td>Microstructural Characterization of Hypoeutectoid Steels Quenched from Ae1-Ae3 Intercritical Temperature Range by Magnetic Barkhausen Noise Technique</td>
<td>B. Boyacıcıoğlu</td>
</tr>
</tbody>
</table>
A. Selected Papers published in International Journals


25. Gür CH, Çam I, Investigating the Effects of Quenching and Tempering on Steel Microstructures by Magnetic Barkhausen Noise Method. 8th Int. Quenching and Control of Distortion Conf. - ASM, 9-12 Sept 2012 Chicago-USA, 238-243


32. Yelbay I., Çam I., Gür H. Prediction of Surface Residual Stresses in Butt-Welded Steel Plates by Magnetic Barkhausen Noise Analysis. 7th Int. Quenching and Control of Distortion Conf. - ASM, 6-11 June 2011 Chicago-USA, Paper no: 01.05


44. Batıgün, C., Tirekş, S. Effect of line energy on the weld geometry and Mg content of the weld metal in MIG welding of Al-Mg alloys. Welding Technology VI. National Congress, 9-10 Nov 2007 Ankara.

50. C.H.Gür, I.Çam, Comparison of Magnetic Barkhausen Noise and Sound Velocity Measurements for Characterisation of Steel Microstructures, 8th ECNDT, 25-29 Sept 2006 Berlin, Mo 2.2.4
52. Gür CH, Çam İ, Non-destructive characterisation of quenched/tempered AISI/SAE 1040 steel by magnetic Barkhausen noise and sound velocity measurements, 5th Int Conf on Barkhausen Noise and Micromagnetic Testing, 2-3 June 2005 Petten, 29-36