

*ISSN: 2603-4018*  
*eISSN: 2603-4646*

---

## **INTERNATIONAL JOURNAL**

for science, techniques and innovation  
for non-destructive inspection  
and material evaluation for the industries



## **NDT DAYS**

*Volume II / Issue 3*

*Year 2019*

---

**Published by Bulgarian Society for Non-Destructive Testing**  
**Member of ICNDT and EFNDT**

# International Journal “NDT Days”

ISSN: 2603-4018, eISSN: 2603-4646

PUBLISHER: Bulgarian Society for NDT (BG S NDT)

FOUNDERS: Bulgarian Society for NDT, Institute of Mechanics at the Bulgarian Academy of Sciences

The scope of the journal is aimed to all methods and techniques of non-destructive and destructive testing, as well as evaluation of materials and structures in all areas of technical activities. It is an opportunity to publish research and development results, together with good practices and recommendations for standardization.

Submitted manuscripts should not have been published previously and should not be currently under consideration for publishing elsewhere.

They should be prepared in accordance with the Instructions for Authors, published on the journal site.

The articles appearing in the Journal are indexed in NDT Net.

## THEMATIC FIELDS

### 1. Non-destructive inspection methods

- Non-destructive testing methods (ultrasonic, penetrant, magnetic, visual, infrared thermography, radiography, leek, etc.);
- Non-destructive and destructive inspection of the integrity, structure and physico-mechanical properties of materials;
- Application of non-destructive and destructive testing methods for inspection in energy, transport, engineering, construction, chemical industry, etc.;
- Structural health monitoring of equipment and structures with non-destructive testing methods (vibration diagnostics, acoustic emission, infrared thermography, etc.);
- Advanced non-destructive testing methods and techniques (phased array, TOFD, computer and digital radiography, tomography, automatic system for inspection, shearography, etc.);
- Training, certification, accreditation and standardization in scope of non-destructive inspection and conformity assessment of materials, equipment and structures.

### 2. Techniques for material processing and condition monitoring of equipment

- Design and construction;
- Life cycle condition monitoring;
- Material sciences;
- Manufacturing, exploitation, maintenance and repair;
- Innovation methods and techniques for modernization;
- Metal casting, welding, soldering bonding, machining, surface treatment;
- Mathematical modeling of technological processes;
- Load treatment and deformation;
- Training.

OFFICIAL LANGUAGES: Bulgarian, English and Russian

## EDITORIAL BOARD

### EDITOR IN CHIEF

**Mitko MIHOVSKI**, President of BG S NDT, Sofia, Bulgaria

### DEPUTY EDITOR IN CHIEF

**Peter DJONDJOROV**, Institute of Mechanics at the Bulgarian Academy of Sciences, Sofia, Bulgaria

### SCIENTIFIC SECRETARIES

**Yordan MIRCHEV**, Institute of Mechanics at the Bulgarian Academy of Sciences, Sofia, Bulgaria

**Krassimira IVANOVA**, Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences, Sofia, Bulgaria

### MEMBERS

**Victor CHIRIKOV**, Technical University of Varna, Varna, Bulgaria

**Pavel CHUKACHEV**, Multitest Ltd., Varna, Bulgaria

**Dimitar DIMOV**, University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria

**Hristo DRAGANCHEV**, Technical University – Varna, Varna, Bulgaria

**Grigorii DYMKIN**, Emperor Alexander I St. Petersburg State Transport University, Saint-Petersburg, Russia

**Borislav GENOV**, Defence Institute “Prof. Tsvetan Lazarov”, Sofia, Bulgaria

**Ivan GEORGIEV**, Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences, Sofia, Bulgaria

**Eduard GORKUNOV**, Institute of Engineering Science, Ural Branch of the Russian Academy of Science, Ekaterinburg, Russia

**Janez GRUM**, University of Ljubljana, Slovenia

**Yonka IVANOVA**, Institute of Mechanics at the Bulgarian Academy of Sciences, Sofia, Bulgaria

**Vasil KAVARDJIKOV**, Institute of Mechanics at the Bulgarian Academy of Sciences, Sofia, Bulgaria

**Ivan KOLAROV**, Todor Kableshkov University of Transport, Sofia, Bulgaria

**Vladimir KOSTIN**, M.N. Mikheev Institute of Metal Physics of Ural Branch of Russian Academy of Sciences; Yekaterinburg, Russia

**Vadim KOVTUN**, Gomel Branch of the University of Civil Protection of the Ministry for Emergency Situations of the Republic of Belarus, Gomel, Belarus

**Sergey KRIVOSHEEV**, Peter the Great Polytechnic University, Saint Petersburg, Russia

**Emil MANOAH**, Institute of Mechanics at the Bulgarian Academy of Sciences, Sofia, Bulgaria

**Svetozar MARGENOV**, Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences, Sofia, Bulgaria

**Boris MIHAYLOV**, SPECTRI Ltd, Sofia, Bulgaria

**Giuseppe NARDONI**, International Academy on NDT, Brescia, Italy

**Alexander NAZARYTHEV**, Federal State Educational Establishment “PEIPK”, Saint Petersburg, Russia

**Amos NOTEA**, Technion, Israel Institute of Technology, Haifa, Israel

**Anna POVOLOTSKAYA**, Institute of Engineering Science, Ural Branch of the Russian Academy of Science, Ekaterinburg, Russia

**Vladimir PROHOROVICH**, ITMO University, Saint Petersburg, Russia

**Nikolay RAZYGRAEV**, State Reseach Center of Russian Federation CNITMASH, Moscow, Russia

**Vladimir SERGIENKO**, V.A. Belyi Metal-Polymer Research Institute of the NAS of Belarus”, Gomel, Belarus

**Yossi SHOEF**, Israeli National Society for NDT, Tel Aviv, Israel

**Alexandar SKORDEV**, Certification Center for NDT Personnel at the Bulgarian Society for NDT, Bulgaria

**Marin STOYCHEV**, Institute of Metal Science, Equipment, and Technologies with Hydro- and Aerodynamics Centre “Acad. A. Balevski”, Sofia, Bulgaria

**Maciej SULOWSKI**, AGH University of Science and Technology, Krakow, Poland

**Alexey TADJIBAEV**, Federal State Educational Establishment “PEIPK”, Saint Petersburg, Russia

**Vasilij TITKOV**, Peter the Great Polytechnic University, Saint Petersburg, Russia

**Vladimir TROITSKY**, E. O. Paton Electric Welding Institute of the NAS of Ukraine, Kiev, Ukraine

**Valeriy VENGRINOVICH**, Institute of Applied Physics of the NAS of Belarus, Minsk, Belarus

**EDITORIAL OFFICE:** International Journal “NDT Days”  
Institute of Mechanics, Bulgarian Academy of Sciences  
Acad. G. Bonchev Str., Block 4, Sofia – 1113, Bulgaria  
phone: +359 2 9797120  
e-mail: [ndtdays@abv.bg](mailto:ndtdays@abv.bg)  
<http://www.bg-s-ndt.org/journal.html>

Publishing of Volume II (2019) of the International Journal “NDT Days” is partially financed by Project NF-2/2019

## Table of Contents

Effect of Cyclic Loading on the Magnetic Behaviour of Hot-Rolled Pipe Steel 08G2B .....	245
Eduard GORKUNOV, Anna POVOLOTSKAYA, Sergey ZADVORKIN, Evgeniia PUTILOVA, Aleksandr MUSHNIKOV	
Влияние циклического нагружения на поведение магнитных характеристик горячекатаной трубной стали 08Г2Б	
Эдуард ГОРКУНОВ, Анна ПОВОЛОЦКАЯ, Сергей ЗАДВОРКИН, Евгения ПУТИЛОВА, Александр МУШНИКОВ	
Promises for Non-destructive Testing of Complex-shaped Steel Products with Low Coercive Force .....	255
Yuriy Ya. REUTOV, Vladimir I. PUDOV, Tatyana D. BELKOVA	
Перспективы неразрушающего контроля стальных изделий сложной формы с малой коэрцитивной силой	
Юрий Я. РЕУТОВ, Владимир И. ПУДОВ, Татьяна Д. БЕЛЬКОВА	
Linear Synthesis of Non-Axial Surface Eddy Current Probes.....	259
Vladimir Ya. HALCHENKO, Ruslana V. TREMBOVETSKAYA, Vladimir V. TYCHKOV	
Линейный синтез несоосных накладных вихретоковых преобразователей	
Владимир Я. ГАЛЬЧЕНКО, Руслана В. ТРЕМБОВЕЦКАЯ, Владимир В. ТЫЧКОВ	
Modeling of the Effect of Attenuation of Ultrasonic Longitudinal Waves in Cast Iron with Flake Graphite on the Characteristics of Pulse Signals.....	269
Vadim N. DANILOV, Liubov V. VORONKOVA	
Моделирование влияния затухания ультразвуковых продольных волн в чугуна с пластинчатым графитом на характеристики импульсных сигналов	
Вадим Н. ДАНИЛОВ, Любовь В. ВОРОНKOVA	
Direct Measurement of the Normal Acoustic Impedance of Sound-Absorbing Materials Using Laser Doppler Vibrometer .....	278
Sergey N. BUKHAROV, Alexander R. ALEXIEV	
Testability and Test Accessibility of Object for Non Destructive Inspection.....	284
Aleksandar SKORDEV	
Контролопригодност и контролодостъпност на обектите за контрол без разрушаване	
Александър СКОРДЕВ	
Revealing the Stresses-New Approach for Industrial Safety, Reliability and Residual Life Assessment.....	291
Isaac EINA V	
Sintered Fe-Mn-Si-C Steels .....	300
Paulina GŁOWACZ, Monika TENEROWICZ-ŻABA, Maciej SUŁOWSKI, Janusz KONSTANTY	

Preparation and Morphology of Chromium Coating with Diamond Nanoparticles on Aluminum Alloys.....	307
Vladimir PETKOV, Radoslav VALOV, Lyuben LAKOV, Bojidar JIVOV, Stanislav ASENOV, Mihaela ALEKSANDROVA	
Получаване и морфология на хромови покрития с диамантени наночастици, върху алуминиеви сплави	
Владимир ПЕТКОВ, Радослав ВЪЛОВ, Любен ЛАКОВ, Божидар ЖИВОВ, Станислав АСЕНОВ, Михаела АЛЕКСАНДРОВА	
Corrosion Resistance Study of Coatings of Chromium with Nanodiamonds on Sintered Steel with Different Carbon Concentration.....	314
Vladimir PETKOV, Radoslav VALOV, Vanya DYAKOVA, Yoanna KOSTOVA, Maciej SULOWSKI	
Изследване на корозионната устойчивост на покрития от хром с нанодиаманти върху синтерована стомана с различна концентрация на въглерод	
Владимир ПЕТКОВ, Радослав ВЪЛОВ, Ваня ДЯКОВА, Йоанна КОСТОВА, Мачей СУЛОВСКИ	
Physical Model of the Process of Obtaining a Composite Material Based on the Powder System "Metal – Carbon Nanotubes" by the Method of Electrocontact Sintering .....	321
Vadim KOVTUN, Mitko MIHOVSKI, Vladimir PASOVETS, Yury PLESKACHEVSKY, Yordan MIRCHEV	
Физическа модель на процеса на получаване на композиционен материал на основе порошкова система «метали – въглеродни нанотрубки» методом електроконтактного спекания	
Вадим КОВТУН, Митко МИХОВСКИ, Владимир ПАСОВЕЦ, Юрий ПЛЕСКАЧЕВСКИЙ, Йордан МИРЧЕВ	
Sensitivity Analysis of the Thermal Task at Electric Arc Welding .....	336
Manahil TONGOV	
Анализ на чувствителността на топлинната задача при електродъгово заваряване	
Манахил ТОНГОВ	
Innovative Modular System with CNC for Automation of Welding Processes .....	345
Plamen TASHEV, Manahil TONGOV, Asen TASEV	
Иновативна модулна система с програмно управление за автоматизация на заваръчни процеси	
Пламен ТАШЕВ, Манахил ТОНГОВ, Асен ТАСЕВ	
Techniques for Modification of the Weld Metal with Nanopowders (Review) .....	353
Christo KONDOV	
Обзор на техники за модифициране на метала на заваръчния шев с нанопрахове	
Христо КОНДОВ	
Guidelines for the Use of the Standard ISO 18166 in Welding Processing.....	359
Manahil TONGOV	
Насоки за използване на стандарта ISO 18166 в заваръчното производство	
Манахил ТОНГОВ	