ФОНД ОЦЕНОЧНЫХ СРЕДСТВ ПО ДИСЦИПЛИНЕ

«ПРОФЕССИОНАЛЬНАЯ ПОДГОТОВКА НА АНГЛИЙСКОМ ЯЗЫКЕ»

МОДУЛЬ «МЕЖДУНАРОДНАЯ НОРМАТИВНО-ТЕХНИЧЕСКАЯ ДОКУМЕНТАЦИЯ ПО НЕРАЗРУШАЮЩЕМУ КОНТРОЛЮ»

Материалы текущего контроля

Радел 1: Неразрушающий контроль и оценка технического состояния / Nondestructive Testing and Nondestructive Evaluation

Pre-reading tasks:
Ex. 1: You are going to read a text about Nondestructive Testing and Nondestructive Evaluation. What do you suppose is the difference between these terms?

Ex. 2: Before reading the text, discuss the meaning of the following words and phrases. Underline those words and phrases that are unknown to you.

interdisciplinary field	to implement tests
flaw	cost-effectiveness
to perform a function	inspection
to locate a defect	formability
fracture toughness	to determine properties

Reading: Now read the text and get ready to discuss the following points:

- What is NDT?
- Where is NTD used?
- What are the advantages of NDT?
- What's the difference between NDT and NDE?

TEXT A

The field of **Nondestructive Testing** (NDT) is a very broad, **interdisciplinary field** that plays a critical role in assuring that structural components and systems **perform their function** in a reliable and cost effective fashion. NDT technicians and engineers define and **implement tests** that locate and characterize material conditions and **flaws** that might otherwise cause planes to crash, reactors to fail, trains to derail, pipelines to burst, and a variety of less visible, but equally troubling events. These tests are performed in a manner that does not affect the future usefulness of the object or material. In other words, NDT allows parts and material to be inspected and measured without damaging them. Because it allows inspection without interfering with a product's final use, NDT provides an excellent balance between quality control and **cost-effectiveness**. Generally speaking, NDT applies to industrial inspections.

Technology that is used in NDT is similar to those used in the medical industry; yet, typically nonliving objects are the subjects of the inspections.

Ex. 3: Look back at the words and phrases in Ex. 2. Which of the underlined items can you explain now?

NDT/NDE METHODS

Pre-reading task: As a class, enumerate all methods of nondestructive testing that you are familiar with. Can you tell something about each of them before reading the text?

Ex. 1: Read the text about some NDT methods quickly. For each numbered paragraph in the text choose the appropriate name of the method from the list:

a) Magnetic Particle Testing (MPI)
b) Acoustic Emission Testing (AE)
c) Radiography (RT)
d) Visual and Optical Testing (VT)
e) Leak Testing (LT)
f) Penetrant Testing (PT)
g) Ultrasonic Testing (UT)
h) Electromagnetic Testing (ET)

TEXT B: NDT METHODS

Many people are already familiar with some of the technologies that are used in NDT and NDE from their uses in the medical industries. Most people have also had an X-ray taken and many mothers have had ultrasound used by doctors to give their baby a check up while still in the womb. X-rays and ultrasound are only few of the technologies used in the field of NDT/NDE. The number of NDT methods that can be used to inspect components and make measurements is large and continues to grow. Researchers continue to find new ways of applying physics and other scientific disciplines to develop better NDT methods. However, there are six NDT methods that are used most often. These methods are visual inspection, penetrant testing, magnetic particle testing, electromagnetic or eddy current testing, radiography, and ultrasonic testing. These methods and a few others are briefly described below.

1. This method involves using an inspector's eyes to look for defects. The inspector may also use special tools such as magnifying glasses, mirrors, or borescopes to gain access and more closely inspect the subject area. Visual examiners follow procedures that range from simple to very complex.

Ex. 3: Look at the list of words and phrases below. Divide them into 8 boxes according to what method they are used to describe in the text. Then, translate them into Russian.

acoustic emission	imaging media	shadowgraph
alternating magnetic field	interruptions	special tools
bleedout	iron particles	to accomplish
borescope	listening devices	to distort
developer	magnifying glass	to dust
dimensional features	penetrant	to fluoresce

Visual and Optical Testing		
Penetrant Testing		
Magnetic Particle Testing		
Electromagnetic Testing		
Radiography		
Ultrasonic Testing		
Acoustic Emission Testing		
Leak Testing		

Ex. 3: Using the words in each box write about NDT methods mentioned in the text.

<u>Vocabulary practice</u>

Ex. 1: Fill in the correct word from the list below. Use the words only once.

interdisciplinary	to perform	dimensional
radioactive	magnifying	iron
dye	ferromagnetic	to locate
to gain	permeability	to look for

_____	glasses	_____	a function
_____	a defect	_____	solution
_____	particles	_____	property
_____	access	_____	imperfections
_____	isotope	_____	field
_____	features	_____	material

Ex. 2: Match the synonyms in A and B:

A.	B.
a) defect	1) to notice
b) testing	2) changing
c) method	3) imperfection

d) alternating	4) X-ray machine
e) to accomplish	5) inspection
f) to grow	6) technique
g) to detect	7) to achieve
h) X-ray generator	8) to increase

Language development

Ex. 1: Study the list of some special tools and devices. In pairs, think of the NDT methods they can be used in. Add some more tools or devices. Present your ideas to the class.

borescope	**endoscopes**
X-ray machine	**mirror**
computer	**pulser/receiver**
voltmeter	**ammeter**
magnifying glass	**permanent magnets**

Ex. 2: Write 10 words for each NDT method

Радел 2: Методы неразрушающего контроля и диагностики / Nondestructive Testing and Nondestructive Evaluation Methods

NDT Test Methods

Test method names often refer to the type of penetrating medium or the equipment used to perform that test. Current NDT methods are:

_____ (AE), _____ (ET),
_____ (LT), _____ (PT),
_____ (MT), _____ (RT),
_____ (IR), _____ (UT),
_____ (VT).

Magnetic Particle Testing

Magnetic Particle Testing uses one or more _____ fields to locate surface and _____ discontinuities in _____ materials. The _____ field can be applied with a permanent _____ or an electromagnet. When using an electromagnet, the field is present only when the _____ is being applied. When the magnetic field encounters a discontinuity _____ to the direction of the magnetic field, the flux lines produce a magnetic flux leakage field of their own. Because magnetic flux lines don't travel well in air, when very fine colored _____ particles are applied to the surface of the part the particles will be drawn into the discontinuity, reducing the air gap and producing a visible _____ on the surface of the part. _____ light.

Liquid Penetrant Testing

The basic principle of liquid penetrant testing is that when a very low viscosity liquid (the _____) is applied to the surface of a part, it will penetrate into fissures and voids open to the surface. Once the excess penetrant is removed, the penetrant trapped in those voids will flow back out, creating an _____. Penetrant testing can be performed on magnetic and non-magnetic materials, but does not work well on _____ materials. Penetrants may be "visible", meaning they can be seen in ambient light, or fluorescent, requiring the use of a _____ light. When performing a Penetrant testing inspection, it is imperative that the surface being tested is clean and free of any foreign materials or liquids that might block the penetrant from entering voids or fissures open to the surface of the part.

Thermal/Infrared Testing

Thermal/Infrared Testing, or infrared thermography, is used to measure or map surface temperatures based on the infrared _____ given off by an object as heat flows through, to or from that object. The majority of infrared _____ is longer in wavelength than visible light but can be detected using thermal imaging devices, commonly called _____. Used properly, thermal imaging can be used to _____ corrosion damage, delaminations, disbonds, voids, inclusions as well as many other detrimental conditions.

LIQUID PENETRANT TESTING

1. Liquid penetrant testing is based on the principle of:
(a) Polarized sound waves in a liquid
(b) Magnetic domains
(c) Absorption of X-rays
(d) Capillary action
2. When a small diameter tube is placed in a glass of water, water rises in the tube to a level above the adjacent surface. This is called:
(a) Viscosity
(b) Capillary action
(c) Surface tension
(d) Barometric testing
3. How is the size of a liquid penetrant indication usually related to the discontinuity it represents:
(a) Larger than
(b) Smaller than
(c) Equal to
(d) Not related to
4. A penetrant that is self-emulsifying is called:
(a) Solvent removable
(b) Water washable
(c) Post-emulsified

(d) Dual sensitivity method

5. A penetrant process which employs an emulsifier as a separate step in the penetrant removal process is called:

(a) Solvent removable
(b) Water washable
(c) Post-emulsified
(d) Dual sensitivity method

MAGNETIC PARTICLES TESTING

1. Magnetic particles testing is most likely to find subsurface discontinuities in:

(a) Soft steels with high permeability
(b) Soft steels with low permeability
(c) Hardened steels with low permeability
(d) Hardened steels with high permeability

2. Which of the following is not an advantage of magnetic particles testing?

(a) Fast and simple to perform
(b) Can detect discontinuities filled with foreign material
(c) Most reliable for finding surface cracks in all types of material
(d) Works well through a thin coat of paint

3. Which of the following does not represent a limitation of magnetic particle testing?

(a) The type of materials which may be effectively tested
(b) The directionality of the magnetic field
(c) The need for demagnetization
(d) The ability to detect discontinuities filled with foreign material

4. The most effective NDT method for locating surface cracks in ferromagnetic materials is:

(a) Ultrasonic testing
(b) Radiographic testing
(c) Magnetic particle testing
(d) Liquid penetrant testing

5. Which of the following may cause magnetic particle test indications?

(a) A joint between two ferromagnetic materials of different permeability
(b) A shrink fit joint in ferromagnetic materials
(c) A brazed joint in ferromagnetic materials

RADIOGRAPHIC TESTING

1. Which of the following viewing conditions is most desirable for interpreting radiographic film?

(a) Well lit viewing room
(b) Totally dark viewing room
(c) Brightness of surroundings approximately the same as the area of interest on the radiograph
(d) None of the above

2. Which of the following is classified as electromagnetic radiation?
(a) Visible light
(b) X rays
(c) Infrared radiation
(d) All of the above
3. A densitometer is an instrument that measures:
(a) Radiographic contrast
(b) Radiographic density
(c) Radiographic sensitivity
(d) Radiographic resolution
4. Thicker materials would normally be inspected using:
(a) Lower kV X rays
(b) Lower mA X rays
(c) Higher mA X rays
(d) Higher kV X rays
5. Betatrons are used to produce X-rays in what range?
(a) 0-50 keV
(b) 50-500 keV
(c) 500-1000 keV
(d) Several MeV

ULTRASONIC TESTING

1. The piezoelectric material in a search unit which vibrates to produce ultrasonic waves is called:
(a) A backing material
(b) A lucite wedge
(c) A transducer element or crystal
(d) A couplant
2. A noisy base line, or hash may result in:
(a) Laminations in the test piece
(b) Discontinuities at an angle to the test piece surface
(c) Large grain size
(d) Fatigue cracks
3. Sound waves which travel on the surface of a solid in a manner similar to waves on a water surface are called:
(a) Rayleigh waves
(b) Shear waves
(c) Primary waves
(d) Compression waves
4. Lamb waves are formed in a part which has:
(a) A thickness greater that about ten wavelengths
(b) A thickness approximately equal to the wavelength
(c) Low acoustic impedance compared to the transducer crystal material
(d) A thickness of about four wavelengths

5. Which type(s) of sound wave modes will propagate through liquids?
(a) Longitudinal
(b) Shear
(c) Surface
(d) All of the above

Радел 3: Выбор методов неразрушающего контроля / Nondestructive Testing Methods Selection

Ex. 1: *NDT Method Selection*

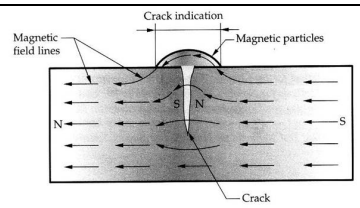
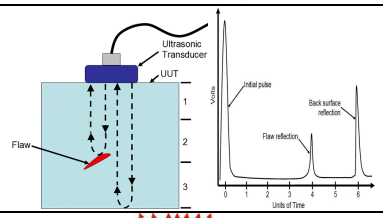
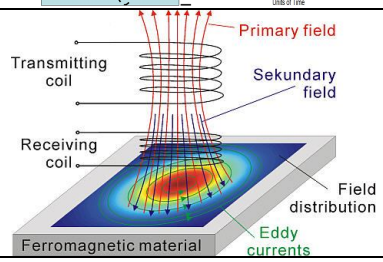
Each NDT method has its own set of advantages and disadvantages and, therefore, some are better suited than others for a particular application. The NDT technician or engineer must select the method that will detect the defect or make the measurement with the highest sensitivity and reliability. The cost effectiveness of the technique must also be taken into consideration. The following table provides some guidance in the selection of NDT methods for common flaw detection and measurement applications.

In groups, study the table. Choose one of the flaw types and discuss the possible applications of NDT methods according to the table. Give your explanations. Choose one person to present your ideas to the class.

Flaw type / NDT method	Visual	Liquid Penetrant	Magnetic Particle	Ultraso-nic	Eddy current
Surface Breaking Linear defect					
Surface Breaking Volumetric defect					
Near-Surface Linear & Normal to Surface					
Near Surface Linear & Parallel to Surface					
Near Surface Volumetric defect					
Subsurface Linear & Normal to Surface					
Subsurface Linear & Parallel to Surface					
Subsurface Volumetric defect					

(0) Will not detect
(1) Not well suited
(2) Fairly well suited
(3) Ideal application

Ex. 2: *Fill in the chart provided below*

FIG	NAME OF NDT METHOD	SCIENTIFIC PRINCIPLES	MAIN USES	MAIN ADVANTAGES	MAIN DISADVANTAGES
					
					
					

Радел 4:
Развитие методов неразрушающего контроля и технической диагностики / Background on Nondestructive Testing and Nondestructive Evaluation

Ex. 1: *Read and translate the text shown below*

Background on Nondestructive Testing and Nondestructive Evaluation

Nondestructive testing has been practiced for many decades. One of the earliest applications was the detection of surface cracks in railcar wheels and axles. The parts were dipped in oil, then cleaned and dusted with a powder. When a crack was present, the oil would seep from the defect and wet the oil providing visual indicating that the component was flawed. This eventually led to oils that were specifically formulated for performing these and other inspections and this inspection technique is now called penetrant testing.

X-rays were discovered in 1895 by Wilhelm Conrad Roentgen (1845-1923) who was a Professor at Wuerzburg University in Germany. Soon after his discovery, Roentgen produced the first industrial radiograph when he imaged a set of weights in a box to show his colleagues. Other electronic inspection techniques such as ultrasonic and eddy current testing started with the initial rapid developments in

instrumentation spurred by technological advances, and subsequent defense and space efforts following World War II. In the early days, the primary purpose was the detection of defects. Critical parts were produced with a "safe life" design, and were intended to be defect free during their useful life. The detection of defects was automatically a cause for removal of the component from service.

Радел 5: Промышленно-опасные объекты / Dangerous Industrial Objects

Ex. 1: Fill in the chart provided below

The List Of Dangerous industrial projects	
Boiler industry objects	
Natural gas industry objects	
Materials handling equipment	
Metal mining industry objects	
Coal-mining industry objects	
Petroleum and natural gas industry objects	
Metal manufacture objects	
Explosive substance, fire risk and chemically dangerous objects	
Railway transport objects	
Grain storage and processing objects	
Buildings and constructions	
Power industry objects	

elevator, lift	centrifuge
mine cage	chemically dangerous substance reservoir
mine hoist	concentrating mill
oil reservoir	entoleter
ore mining and processing enterprise	escalator, moving staircase/stairway
outer steel gas pipeline	Explosive substance cistern; tank
pipelayer crane	fan
well repair equipment	funicular (railway), cable car
electric boiling pan	gantry rail
elevating platform, lifting platform	gas fitting

Радел 6:
Российские и международные стандарты в области неразрушающего контроля / Nondestructive Testing Russian And International Standards

Ex. 1: Find the relevant terms and definitions given in Tables 1 and 2

Table 1

1.	Acoustic Emission Testing (AE)
2.	Acoustic Impedance (Z)
3.	Acoustic Properties
4.	Ampere
5.	Amplifier
6.	Amplitude
7.	Attenuation
8.	Background fluorescence
9.	Calibration

Table 2

	A break, or separation, of a part into two or more pieces.
	A bright vivid color that glows under a black light.
	A crack in weld metal.
	A device for limiting the effects of beam spread.
	A device to increase or amplify electric impulses.
	A discontinuity or other imperfection causing a reduction in the quality of a material or component.
	A finely divided powder applied over the surface of a part to help bring out penetrant indications.

Список использованных источников:

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