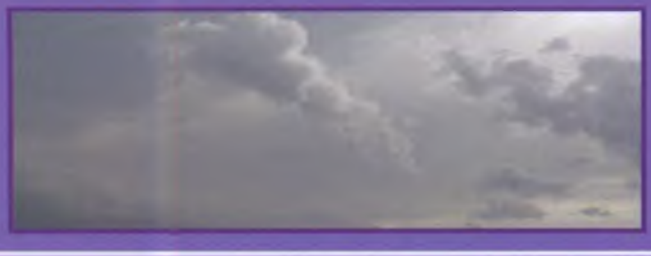

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CONTENTS

THE USE OF MAGNETIC PHENOMENA IN NON-DESTRUCTIVE CONTROL

Mussina Zh.K., Abisheva M.Zh.

Keywords: magnetic, magnetic field, non-destructive control, magnetic particles, defect, railway transport, magnetization, ferromagnetic materials.

Abstract. Offered in the article non-destructive magnetic method of control for the search of micro-defects in a variety of ferromagnetic materials.

ИСПОЛЬЗОВАНИЕ МАГНИТНЫХ ЯВЛЕНИЙ В НЕРАЗРУШАЮЩЕМ КОНТРОЛЕ

Мусина Ж.К., Абишева М.Ж.

Ключевые слова: магнетизм, магнитное поле, неразрушающий контроль, магнитные частицы, дефект, железнодорожный транспорт, намагниченность, ферромагнитные материалы.

Аннотация. В статье предложен неразрушающий магнитный метод контроля для поиска микродефектов в различных ферромагнитных материалах.

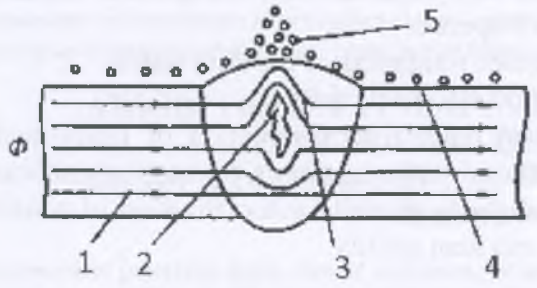
Today, magnetic phenomena are an important part of science. We all sometimes come across magnetic properties of some materials and magnetism phenomenon in our everyday life. Magnetic field properties directly or indirectly in form of residual magnetism have already become an essential part of our life and are widely used in science and different technical appliances. Being invisible and material at the same time magnetic field features unique properties. Magnetic interaction between the objects standing apart in the space is executed via a special material carrier.

Magnetic field characteristics to be measured are: magnetic induction vector, field intensity, magnetic flux (magnetic flow), magnetic field gradient etc. Magnetic state of an object is characterized by: intensity of magnetization – resulting value of magnetic moment per unit volume (ormass) of substance; magnetic susceptibility, magnetic per meability and magnetic structure. The key characteristics of the most popular magnetic materials, i. e. ferromagnetics, are: induction and magnetization curves, coercive force, energy loss for reversal magnetization, maximum magnetic energy per unit volume (or mass) of substance, demagnetization factor (demagnetization coefficient) of ferromagnetic sample [1].

Magnetic non-destructive control method is widely used today in control ferro magnetic items for microdefects. This method is based on use of properties of magnetic particles concentrated on imperfections of object magnetic field. These imperfections appear due to presence of defects in material. Generally, the magnetic control process is as following. An item to be tested is magnetized there upon it is covered by magnetic particles. Then, particles accumulate at defects zones there by forming their distinct «traces». Attracting to each other and being orientated according to magnetic field lines the particles create chains and figures in form of rolls thus indicating presence and complicacy of defects. Defects are detected the best way when defect surface is 90°C to magnetic flow. The less this angle the less

method sensitivity and that makes defect detection less probable. There are two magnetic particle control methods: one method uses particles (dry method) and the other uses special magnetic suspension (wet method). Subject to form, size and magnetic properties of the object tested and presence of non-magnetic coating one can test it for residual magnetization as well as for magnetic field applied.

Magnetic particle control is often used in railway transport, aviation, shipbuilding, chemical machine building, machine building, oil- and gas production industries (pipeline tests). Magnetic particle control provides high effectiveness, sensibility as well as clear test results. When used appropriately this method can provide detection of defects at the very beginning of their formation.



1 – magnetic field;
2 – defect;
3 – the distortion of the magnetic field;
4 – magnetic suspension;
5 – the accumulation of particles.

Fig. 1. Magnetic particle method of non-destructive control

Building up magnetization in substance being placed in magnetic field can be accounted for gradual orientation of magnetic moments of circulating micro currents toward the field [3].

Magnetic control methods can be used only for control ferromagnetic materials to detect material discontinuity situated at surface and subsurface areas and sometimes inside the item tested, i. e. cracks (fatigue, grinding, tempering, welding, forging and stamping cracks), hair lines, laps, laminations (non-parallel surfaces), flakes, surface tears, lacks of penetration in welding connections and non-metallic inclusions. These methods can be used to detect ferrite inclusions in items made of austenitic alloys.

Some technological processes used for manufacturing items can be corrected by magnetic methods (grinding, thermal treatment, welding, forging, stamping, broachetc.).

Due to high sensitivity, objectivity, simplicity and operation quickness, clear detection of defects and reliability the magnetic methods are mostly used in multiple industries.The methods advantage is in its ability to test items of complicated shape and different sizes.

Today, magnetic control methods develop in the following two ways: use of dry powder developers as indicators or electromagnetic and electronic systems [2].

Magnetic control method can provide:

- superficial (with crack width at surface 0.002 mm and more at the depth of 0.01 mm and more);
- subsuperficial - at the depth of 2 mm and less;
- internal (big sizes) at the depth of 2 mm and more; cracks at the depth of 8

mm and less and lacks of penetration at the depth of 6 mm and less;

Advantages of magnetic methods:

- cost effectiveness of the method;
- environment friendly and safe for operator;
- high effectiveness.

Disadvantages of the method:

- weld reinforcement significantly reduces sensitivity of control methods;
- special inclusions are detected poorly than flat and crack-like inclusions. Pores and slag inclusions are detected insufficiently;
- reliability of results considerably depends on subjective factors: qualification, experience and good faith of operator;
- method sensitivity depends on surface roughness of the item tested.

As surface roughness rises the method sensitivity falls.

The control methods studied above require no destruction of ready-made items and cutting of samples. Use of these methods allows to avoid significant temporary and material expenditures and partly promote automatization of control operations thereby enhancing reliability and item quality.

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ПОГЛОЩЕНИ

Расулов Р.Я

Ключевые слова: п
поглощения света, ра
Аннотация. Теорети
полупроводниковой
между ветвями легки
Анализированы осно
размерно-квантованн
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Rasulov R.

Keywords: polarized
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