SENSORS PRODUCTION TECHNOLOGIES

ТЕХНОЛОГІЯ ВИРОБНИЦТВА СЕНСОРІВ

UDC 655.336:621,37/39:534
DOI http://dx.doi.org/10.18524/1815-7459.2017.1.96442

METHOD OF STENCILLING IN TECHNOLOGY OF DEVICES ON SURFACES ACOUSTIC WAVES

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Abstract. The method of acoustoabsorber putting on acoustic ducts of devices on the surface acoustic waves, basing on stencilling which used at manufacturing of thick-film hybrid integrated circuits is described.

The block diagram of technological process of acoustoabsorber deposition is given. Features of the separate operations are discussed.

Keywords: acoustoelectronic device on surface acoustic waves, acoustoabsorber, stencilling

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Анотація. У роботі описано метод нанесення акустопоглинача на звукопроводи пристроїв на поверхневих акустичних хвилях, що базується на трафаретному друці, який використовується при виготовленні товстоплівкових гібридних інтегральних схем.

Приведено структурну схему технологічного процесу нанесення акустопоглинача. Обговорюються особливості окремих операцій.

Ключові слова: акустоелектронний пристрій на поверхневих акустичних хвилях, акустопоглинач, трафаретний друк

МЕТОД ТРАФАРЕТНОЙ ПЕЧАТИ В ТЕХНОЛОГИИ УСТРОЙСТВ НА ПОВЕРХНОСТНЫХ АКУСТИЧЕСКИХ ВОЛНАХ

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Аннотация. В работе описан метод нанесения акустопоглотителя на звукопроводы устройств на поверхностных акустических волнах, базирующийся на трафаретной печати, использующейся при изготовлении толстопленочных гибридных интегральных схем.

Приведена структурная схема технологического процесса нанесения акустопоглотителя. Обсуждаются особенности отдельных операций.

Ключевые слова: акустоэлектронные устройство на поверхностных акустических волнах, акустопоглотитель, трафаретная печать

Introduction

It is known, [1, 2, 3] that electric characteristics of devices on surface acoustic waves (SAW) are deformed substantially by the false acoustic signals caused by reflections from acoustic ducts borders. The basic method of elimination of the SAW reflected from borders is application of acoustoabsorber materials, which apply on the appropriate acoustic duct sites [1, 4]. Till now in most cases the operation of acoustoabsorber applying is carried out by primitive ways and the means, lowering the effectiveness of devices on SAW as a whole, the basic operations which are manufacturing are carried out by the group methods borrowed from thin-film technology.

The basic part

In the present work one of effective methods of acoustoabsorber applying on acoustic duct - a stencilling method is described.

The method is borrowed from the thick-film

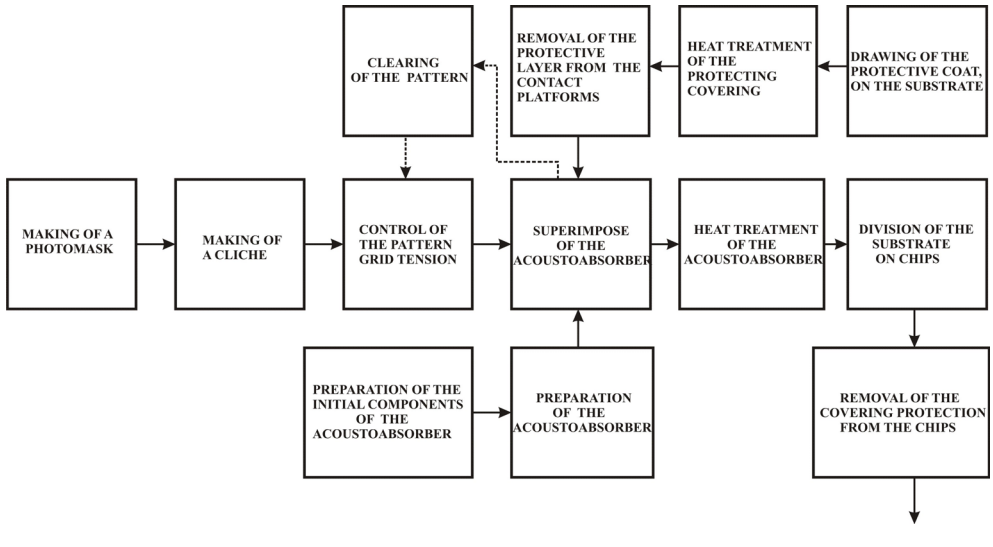

Fig. 1 The block diagram of acoustoabsorber putting technological process.

technology [5-7]. As well as any another it has restrictions in application as technical which are caused, on the one hand, by its specificity, and, on the other hand, by the appropriate characteristics used for this purpose acoustoabsorber materials, and economic. The block diagram of the technological process realizing this method, applicable to devices on SAW is given in fig. 1.

The wide range of characteristics of acoustoabsorber, determining an opportunity of application for their putting a method of stencilling, causes the appropriate range of technological method modes.

Application of the automated special technological equipment thus provides essential decrease of labor expenditures of devices on SAW manufacturing process in conditions of mass production, quality improvement of their characteristics and good economic product parameters.

Quality of the acoustoabsorber putted layers depends on such its characteristics, as spreadability, viscosity, polymerization time, temperature influence on the latter, on physical and chemical acoustoabsorber compatibility and a acoustic duct material, its «life time», and also on a pattern type, its grid tension degree and on parameters of scraper movement of stencilling plant [8, 9]. That's why the modes of putting technological operations are picked in view of used acoustoabsorber and acoustic duct characteristics.

In order to prevent damage of interdigital converters (IDC) and acoustic duct working surface devices on SAW it is necessary to cover it with a protective layer. Good results are achieved by putting on IDC a protective layer from photoresist of any marks used in thin-film technology, for example PhRP-11, PhRN-383. This operation is carried out with the help of the same equipment which is used at a photolithography, for example, plant of photoresist putting by a method of centrifugation PNF-6C-DT30-3 and a plant of photoresist infra-red drying. After protection of a substrate-acoustic duct surface, removal of a protective layer from IDC contact platforms and acoustoabsorber preparation, the latter is put on the assigned sites with the help of stencilling plan for example AUPT-1. The photoresist protective layer does not render negative influence on acoustoabsorber properties, therefore it can not be removed, from sections under acoustoabsorber as it is offered in [4].

The used machining attachments is determined by substrate-acoustic duct overall dimensions and the geometrical form. The choice of pattern type depends on acoustoabsorber rheological characteristics, and also on the technologist experience. We used a silk screen with capronic grid having the cell size of 120 microns.

Orientation of topology of puted acoustoabsorber concerning SAW converters and borders (or crystallographic axes) of acoustic duct was carried out by overlapping of reference marks on acoustic duct and a pattern. Off-orientation did not exceed 1°, that in most cases is quite sufficient enough, though there is the opportunity of its reduction.

Modes of technological operations are established depending on concrete conditions and can differ essentially. For example, the hydraulic pressure providing inflowing of acoustoabsorber in apertures of a pattern, depends on a corner of a scraper and a pattern surface meeting, its movement speed, scraper blade adjacency density to a pattern, on a gap between a pattern and a substrate. For everyone concrete acoustoabsorber (distinguished by rheological characteristics) these data can change over a wide range.

Scraper movement speed is established in limits from 50 mm/s up to 150 mm/s, and the corner of its meeting with a mask surface (attack corner) is selected depending on acoustoabsorber rheological characteristics in Pe.

For acoustoabsorber [4] scraper attack corner, makes 45°, and its speed - 150 mm/s. The gap between the pattern plane and the acoustic duct surface (substrates) should remain in limits from 0,3 mm up to 0,5 mm in all cases to provide the necessary layer thickness of a puted acoustoabsorber. In the case, when it is not possible to provide the acoustoabsorber necessary layer thickness in one cycle of putting (for one cycle ~30 microns), the putting process must be repeated several of times, using acoustoabsorber drying in an interval between separate operations.

For repeatability increase, quality guarantee of acoustoabsorber putting and increasing of pattern use term it is necessary to make clearing of a pat-

tern grid periodically by chemical solvent which structure is defined by properties of acoustoabsorber used.

The heat treatment of the putted layers which is necessary for removal of flying components from acoustoabsorber, can be carried out in conveyor type thermostove or in of infra-red drying setting from a photolithography line structure (the latter is more preferable), but in all cases the modes should get out in view of necessity of acoustic duct constant piezoelectric properties preservation, i.e. the maximal temperature of heating should not exceed piezoelectric Curie point. At the use of acoustic ducts from $Bi_{12}GeO_{20}$, $Bi_{12}SiO_{20}$, $LiJO_3$ and some other materials it is necessary to avoid significant temperature gradients on substrate volume, otherwise at them cracks can appear.

At the developed technological process, it is necessary to carried out visually surveillance the quality of acoustoabsorber putting, absence of flowings on the converter and breaks of coverings each time at replacement of a material acoustoabsorber or acoustic ducts.

Conclusions

The described technological process of acoustoabsorbers putting go with the requirements of the flexible automated manufacture with the use of the appropriate equipment and provides achievement of high technical and economic parameters in conditions of devices on SAW mass production.

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Стаття надійшла до редакції 10.03.2017 р.

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Summary

The method of acoustoabsorber deposing on acoustic ducts of devices on the surface acoustic waves, basing on stencilling which used at manufacturing of thick-film hybrid integrated circuits is described.

The block diagram of technological process of acoustoabsorber deposition is given. Features of the separate operations are discussed.

Examples of typical industrial equipment are specified.

Optimum modes - hydraulic pressure, scraper movement speed, attack angle and the other putting technological modes and their connection with physic-chemical and technical characteristics acoustoabsorber are given.

Keywords: acoustoelectronic device on surface acoustic waves, acoustoabsorber, stencilling

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Реферат

У роботі описано метод нанесення акустопоглинача на звукопроводи пристроїв на поверхневих акустичних хвилях, що базується на трафаретному друці, який використовується при виготовленні товстоплівкових гібридних інтегральних схем.

Наведено структурну схему технологічного процесу нанесення акустопоглинача. Обговорюються особливості окремих операцій. Вказані приклади типового промислового оснащення.

Наведено оптимальні режими – гідравлічний тиск, швидкість руху ракеля, кут атаки та інші технологічні режими нанесення та їх зв’язок з фізико-хімічними та технологічними характеристиками акустопоглиначів.

Ключові слова: акустоелектронний пристрій на поверхневих акустичних хвилях, акустопоглинач, трафаретний друк