The invention relates to a device formed by at least two parts which are integrally joined to one another, and one of which parts is made of a structure of the thin film type. The invention can advantageously be applied in particular (but not exclusively) to the fabrication of hybrid magnetic heads, in particular with planar structure, that is to say magnetic heads which consist, on the one hand, of a main body (forming one of the parts) comprising one or more parts (for example made of ferrite) assembled together and forming a field-closure magnetic circuit (on which there may, in the conventional way, be one or more windings); and which consist, on the other hand, of a structure (forming the other part) mounted on the main body, this structure being formed by thin films designed to constitute the poles, separated by an air gap, which form the active face of the magnetic head.

The techniques for fabricating substrates which form a magnetic circuit are well-known and are described, in particular, in French Patent Applications No. 86 14974, No. 88 08526, No. 87 14824 and No. 88 08527.

Patent FR-A-1,159,994 describes a way of fabricating a magnetic circuit which does not use a thin-film deposition technology but uses a technology employing parts attached to one another, with pole pieces bonded onto an intermediate metallic part which is itself bonded onto a main magnetic circuit.

Furthermore, an example of producing active faces for magnetic heads by the thin-film technology is found in French Patent Applications No. 87 14824 and No. 86 14974. French Patent Application No. 86 14974 corresponds to European Patent EP-A-270404. The preamble of Claim 1 is based on this document.

As indicated in the last of these patent applications cited (No. 86 14974), further to the improvement in the characteristics useful for a magnetic recording and/or reading head, this type of magnetic head is suitable for mass production, which results in a considerable cost reduction.

This is because a plurality of such magnetic heads can be produced simultaneously on one single substrate, which is then cut up to form individual magnetic heads.

Figure 1 represents an example of a substrate as mentioned above, which itself forms the subject of a patent application No. 87 14824 and which is described hereafter with a view to fullness of the description, since this patent application has not yet been published.

Figure 1 is a perspective view which shows an assembly intended to form simultaneously a plurality of magnetic heads. This assembly is produced in a substrate 1 of magnetic material (for example a ferrite block). The substrate 1 includes an attached plate 3, made of magnetic material, and while this plate 3 has not yet been attached to the substrate 1, parallel notches 2 are made in the latter through the thickness E of the substrate 1; and a constriction 4 is made at the bottom of each notch, in such a way that a notch with a constriction do not reach a face 8 of the substrate 1 opposite to the plate 3.

The constrictions 4 are then filled with a nonmagnetic material, for example by pouring a glass-based material.

The plate 3 is then fixed to the substrate 1 and the substrate 1 is finally machined via the face 8 in order to remove a part 5 (shown in broken lines) of this face which is opposite to the plate 3, until the constrictions 4 are exposed on a new face 9, and machining is carried out until air gaps 6 (formed by the nonmagnetic material) which have the desired width are obtained. Clearly, the constrictions 4 may have the shape of a triangle, as shown in broken lines for the constriction 4a.

The structure thus produced is then cut up into individual magnetic circuits. Cutting is carried out in planes such as P which are located between the notches and are parallel to the axis of the notches; with the structure in Figure 1 being placed in a coordinate

reference system XYZ, with the faces 10 and 11 parallel to the XZ plane, the planes such as P are parallel to the ZY plane.

Cutting is then also carried out, in planes which are not represented and are parallel to the YX plane.

During a subsequent step, each magnetic circuit CM is equipped with a winding 7, as represented in Figure 2. This winding is wound via the notch 2 around a limb of the magnetic circuit CM.

In the case of a thin-film magnetic head, the active face 9 including the air gap 6 is coated with a layer (not represented) of a highly magnetic material, such as the one known by the name Sendust (Fe_x Si_y Al_z). This operation can also be carried out before cutting up into individual magnetic circuits. This coating of highly magnetic material covers the face 9 and a part of the air gap 6 of each magnetic circuit, so as to constitute the 2 poles of the magnetic head.

The substrate from which the field-closure magnetic circuit is formed thus more generally constitutes a host substrate for the thin film or films.

Whatever the thin-film based technology employed for producing the active face of the magnetic head, for example according to the teaching of one or other of the two patent applications cited above, this technology has significant drawbacks as mentioned hereafter:

- the face of the substrate intended to receive the thin film or films, that is to say the substrate which constitutes the magnetic circuit, must be perfectly polished in order to have a surface quality compatible with the deposition of the thin films,
- furthermore, it is difficult to obtain the desired polishing of the face of the substrate without creating a height difference between the ferrite face (which is hard) and the nonmagnetic material (contained in the constrictions 4), for example made of glass, which constitutes the macroscopic air gap and which is less hard. This results in the formation of a fracture zone which impairs the quality of the thin

film,

- it is often necessary to anneal the magnetic thin films deposited on the substrate forming the magnetic circuit or field-closure substrate, and the annealing temperatures may furthermore be incompatible with the materials used with, or in order to produce, this substrate (ferrite constituting the magnetic circuit, glass or other nonmagnetic substance bonding the ferrite parts and filling the macroscopic air gap),
- the magnetic poles are defined by etching during the last production steps. The active surface of the head is therefore not planar since the poles emerge from the surface of the ferrite substrate. Thus, when a wear-resistant layer is to be deposited on the surface of the head, the edges of the sides of the poles constitute weak points for this layer.

The invention relates to a process which makes it possible to overcome these drawbacks, and the invention may of course be applied not only to the particular case of producing thin-film magnetic heads, which has been described by way of example, but also to all cases in which it is desired to produce a device in at least two parts, one of which includes at least one thin film and the other of which constitutes a host substrate for this thin film. The process according to the invention is specified in Claim 1.

The invention will be more clearly understood, and other advantages which it affords will emerge, on reading the following description which is made by way of nonlimiting example with reference to the appended figures, in which:

- Figure 1, already described, shows a known substrate made of magnetic material which is used for producing a plurality of magnetic heads and which can constitute a host substrate for one or more thin films,
- Figure 2, already described, shows a known magnetic head which is obtained by cutting up the substrate shown in Figure 1,

- Figure 3 schematically illustrates a characteristic step of the process of the invention and shows, by a schematic sectional view, a host substrate similar to that shown in Figure 2 and an intermediate assembly attached to the host substrate,
- Figures 4a and 4b are sectional views schematically showing an intermediate substrate represented in Figure 3, before and after an etching step;
- Figure 5 is a sectional view schematically showing the intermediate substrate covered with three thin films;
- Figure 6 is a sectional view schematically showing the intermediate substrate in Figure 5, after a polishing step intended to expose an air gap;
- Figure 7 is a sectional view schematically showing the host substrate covered with two magnetic thin films which are located in the same plane and are separated by an air gap, and forming a magnetic head preform after elimination of the intermediate substrate;
- Figure 8 illustrates, by way of nonlimiting example, a shape which may be given to the poles of a magnetic head;
- Figures 9a and 9b illustrate a step in the process which relates to a masking and etching operation for a first magnetic pole, in a preferred version of the invention which makes it possible to form the magnetic poles on the intermediate assembly, that is to say before elimination of the intermediate support;
- Figures 10a and 10b schematically illustrate a masking and etching step for the two magnetic poles;
- Figure 11 schematically illustrates the successive deposition of three thin films on the intermediate substrate, and illustrates the result of polishing which directly exposes the two magnetic poles separated by the air gap;
- Figure 12 represents the intermediate assembly after a step of polishing or planarizing the thin-film structure shown in Figure 11;
- Figure 13 schematically illustrates the step in which the intermediate assembly is attached to the host

substrate in the preferred version of the process of the invention;

- Figure 14 schematically represents the host substrate supporting the thin-film structure, after elimination of the intermediate substrate.

By way of nonlimiting example, Figure 3 illustrates an application of the invention to the production of magnetic read and/or write heads.

Figure 3 represents a host substrate 10 consisting of a support or substrate of magnetic material, similar to the substrate shown in Figure 1, seen in a section through the plane Y-X in Figure 1. In the example of Figure 3, only two notches 2, 2a are represented, each of which corresponds to one row of magnetic heads, these two rows being separated by cutting at the end of the process, along a broken line; and all the magnetic heads are individually separated by cutting, as mentioned in the preamble.

Figure 3 furthermore shows a structure 11 with one or more thin films. The thin-film structure 11 is formed on a substrate, referred to in the rest of the description as the intermediate substrate 13, together with which the thin-film structure 11 constitutes an intermediate assembly 12.

This illustrates an important characteristic of the process of the invention, which consists in at least partially producing the thin-film structure 11 on a substrate other than that which is intended to receive this structure finally, then in attaching the intermediate assembly 12 to the final substrate or host substrate 10, in contrast to the prior art or [sic] the thin film or films are deposited and processed on the host substrate.

In the nonlimiting example described, in this phase of the process the thin-film structure 11 is formed by the deposition of three superposed films intended to constitute, for each magnetic head, two poles separated by a microscopic air gap, as opposed to the macroscopic air gap constituted by each constriction 4 which are

already shown in Figures 1 and 2. Of course, in order to form the active face of a magnetic head as shown in Figure 2, the intermediate substrate 13 could support a single layer of magnetic material.

Of the three superposed thin films 14, 15, 16 supported by the intermediate substrate 13, the central film 15 is a film of nonmagnetic material (for example made of alumina or of silica) which is intended to constitute microscopic air gaps 20, 20a.

As shown in Figure 3, the intermediate assembly 12 is positioned on the host substrate 10 in such a way that the microscopic air gaps 20 are situated substantially on longitudinal axes 21 of the notches 2, the thin films 14, 15, 16 being oriented towards the constriction 4, that is to say towards that face 9 of the host substrate which communicates with the constrictions 4.

The host substrate 10 and the intermediate assembly 12 are integrally joined to one another by a means which is per se conventional, for example by bonding, using an adhesive product such as, for example, epoxy, or else molten or pulverized glass. The adhesive product is arranged between the host substrate 10 and the intermediate assembly 12, and the latter are pressed against one another by traditional means (not represented) until the adhesive product constitutes a relatively thin intermediate layer 22, for example of the order of 5 microns thick; this intermediate layer is nevertheless thick enough to compensate for the irregularities and surface roughness which the face 9 of the host substrate may have after possible brief polishing.

This demonstrates an important advantage afforded by the process of the invention, which resides in the fact that, further to its bonding function, the intermediate layer 22 fulfils a function of compensating for irregularities and surface roughness which obviates a very high quality polishing step.

Figures 4a and 4b illustrate the preparation of the intermediate substrate 13 with a view to depositing thin films thereon.

The substrate 13 may be made of any material, but this material should preferably be capable of being etched by conventional techniques used in the field of thin-film deposition, in particular conventional techniques of masking and etching by chemical means. This material should also be able to withstand the temperatures (of the order of 500°C, for example) required for annealing the thin films (when this annealing is necessary), and it should have an expansion coefficient compatible with those of the thin films; in brief, the material of the intermediate substrate 13 is chosen to be compatible with the processing which may be required for the thin films.

Thus, in view of the nature of the thin films (which is explained hereafter), a suitable material for constituting the intermediate substrate 13 may be a semiconductor material, for example silicon, or any other type of material such as, for example, germanium, glass, etc.

One face 25 of the intermediate substrate 13 is optionally processed so that it has a maximum surface roughness of a few hundredths of microns; such surface roughness is entirely acceptable and does not risk degrading the properties of the thin films, and it can be obtained easily by using conventional mechanical rectification techniques.

The microscopic air gaps 20, 20a shown in Figure 3 are produced with the aid of stairs etched in the intermediate substrate 13, and the steps should have well-defined sides in order to produce air gaps which are as straight as possible; this can be obtained by chemical, mechanical or other etching.

To this end, according to one characteristic of the process of the invention, the intermediate substrate consists of a monocrystalline semiconductor material. Monocrystalline silica is, for example, highly suitable because it is known to use chemical means to etch therein stairs whose sides accurately follow the crystallographic axes.

In this spirit, use may also, for example, be made of gallium arsenide GaAs.

In the traditional way, a resin mask 26 is deposited on the surface 25 of the intermediate substrate 13 in such a way as to leave an exposed area 27 (Figure 4a).

The silicon of the intermediate substrate 13 is attacked in the exposed area 27 using a technique which is per se conventional, for example a chemical technique; the resin of the mask 26 is then dissolved in a suitable product. The intermediate substrate 13 is then as shown in Figure 4b, with a hollow or recessed area 28 where the exposed area 27 used to be, the bottom 29 of this recess rejoining the surface 25 via stairs 30, 30a with substantially straight sides.

The thin films 14, 15, 16 are then deposited on the surface 25 and the recess 28 by a conventional method, by cathodic sputtering, for example, or else by a chemical vapour deposition (CVD) method which is also conventional.

Figure 5 shows the intermediate substrate 13 when the thin films have already been deposited on these; that is to say it supports the thin-film structure 11.

The first deposited film 14 is a layer of a highly magnetic material such as, for example, that known by the name Sendust (Fe_x Si_y Al_z) with a thickness of, for example, between 1 and 5 microns.

On top of the first film 14 is then found the second film 15 made of a nonmagnetic material which may, for example, be alumina or silica. This second film 15 of nonmagnetic material is intended to form the air gaps 20, 20a on the stairs 30, 30a, and the thickness of these air gaps depends only on the thickness of the second film 15, which may, for example, be between 0.1 and 1 micron.

Of course, for the sake of clarity in the figures, the dimension scale has not been respected in the figures.

On top of the second film 15 is then found the third film 16 made of a magnetic material; the third film

16 is similar when [sic] to its nature and its thickness to the first film 14. It is seen that the thin films 14, 15, 16 perfectly match the shape of the hollow or recessed surface 28 made in the intermediate substrate.

The first, then the second, then the third films 14, 15, 16 are thus superposed in such a way that, during the operations of depositing these films, that is to say from the deposition of the first film 14 to the deposition of the third film 16, it is not necessary to remove the intermediate assembly 12 from the enclosure in which these depositions are carried out. Moreover, no photolithographic step is required between the depositions, which thus avoids all the problems due to cleaning the resins, this cleaning being essential in the prior art in order to obtain good adhesion of the films to one another.

Figure 6 shows the intermediate assembly 12 after a per se conventional polishing operation which makes it possible to eliminate, on each side of the hollow or recessed surface 28, parts 16b, 16c of the third film 16 and parts 15b, 15c (represented in broken lines) of the second (nonmagnetic) film 15, so as to leave in this phase of the process only: the entire first film 14) [sic], a central part 15a of the second film (located in the hollow 28) and the air gaps 20, 20a formed at the stairs 30, 30a, and a central part 16a of the third film 16.

This operation exposes a face 32 of the thin-film structure 11 which is formed by:

- side parts 14b, 14c of the first magnetic film 14 which are located on either side of the hollow 28;
- the central part 16a of the third film 16 of magnetic material;
- one end of each air gap 20, 20a which makes it possible to separate the magnetic central part 16a (of the third film 16) from the magnetic side parts 14b, 14c (of the first film 14);
- the nonmagnetic central part 15a being interposed between the magnetic central parts 14a, 16a.

The host substrate 10 (or field-closure substrate) and the intermediate assembly 12 are then integrally joined to one another as indicated with reference to Figure 3.

The following operation consists in eliminating the intermediate substrate 12 by a chemical, mechanical or other process, as well as in eliminating the central part 14 [sic] of the first film 14 and in optionally eliminating all or part of the nonmagnetic central part 15c of the second film 15.

As shown in Figure 7, this produces the host substrate 10 supporting the thin-film structure 11 (which is now limited to a functional part 11a) via the intermediate assembly layer 22, the structure 11 being formed by magnetic films 14b, 16a, 14c located in a single plane and separated by air gaps 20, 20a and forming active faces 35a, 35b on the opposite side to the host substrate 10.

It now remains only to define the shape of the magnetic poles by etching, on the active faces 35a, 35b, as described, for example, in a French patent application No. 87 14822.

The shape of the magnetic poles may be that represented by way of nonlimiting example in Figure 8, which shows the shape of a first and a second pole P1, P2 which can be produced on each side of an air gap 20, 20a, for example the air gap 20a. In this case, the poles P1, P2 are seen in a plan view as illustrated by an arrow 40 in Figure 7; the first pole P1 being produced in the side magnetic film 14c and the second pole P2 in the central magnetic film 16a.

In order to etch the magnetic poles P1, P2, it is possible to proceed, for example, in the way explained hereafter, the simplicity of which procedure makes it possible not to illustrate the method [sic]:

- a photosensitive coating or resin is deposited on the active faces;
- a single or multiple masking of this coating is then carried out using a mask which has the shape and

dimensions which it is desired to give the poles P1, P2;

- the masked photosensitive coating is exposed;
- after elimination of the resins and masks, etching can be carried out using a conventional method (chemical etching, ion beam etching, plasma etching) in order to obtain the poles P1, P2. Of course, this method causes the poles P1, P2 to emerge from the surrounding surface.

As regards the production and/or mounting of the winding or windings (not represented), this can be done, for example, as described in French Patent Application No. 86 14975. Alternatively, after cutting up or dividing up each magnetic head, the winding or windings can be wound around one limb of the magnetic circuit using the notches 2, 2a.

The following description relates to a preferred version of the process of the invention, which makes it possible to obtain magnetic poles embedded in the intermediate substrate 13, that is to say ones which do not emerge from the surrounding surface.

Figures 9a and 9b illustrate operations which make it possible to obtain in the intermediate substrate 13 the impression of a magnetic pole of similar shape to the magnetic poles P1, P2 shown in Figure 8. Figures 9a, 9b are longitudinal-section views taken along an axis X which is shown in Figure 8 and on which longitudinal sides 46 of the poles P1, P2 are located.

A mask 47 is produced on the surface 25 of the intermediate substrate 13, which mask, after development, leaves an exposed surface 48 having the shape of a magnetic pole shown in Figure 8, this shape being represented in Figure 9a according to the dimension of a side 46 of this magnetic pole.

After attack, for example by chemical means, of the exposed surface 48 and elimination of the resin of the mask 47, a hollow 49 is obtained in the surface 25, this hollow having the shape of a magnetic pole and rejoining the surface 25 via straight stairs 50, 51.

Figures 10a and 10b illustrate a step in the process which makes it possible to produce another hollow, symmetrical with the former, with a view to forming the second pole and while increasing the depth of the preceding hollow 49.

To this end, a second mask 53, which has the shape of the two poles combined, is arranged on the surface 25 of the intermediate substrate 13, so as to define a new exposed surface 54 formed by the hollow 49, then an additional exposed surface 55 having the shape of the second magnetic pole.

On the side of the hollow 49 already produced, and forming a first pattern, superposition with the second pattern to be produced should be as good as possible, but is not of excessively critical character, the second mask 53 will preferably be set back somewhat from the first, as illustrated in Figure 10a, in which it covers the stair 50.

It is seen in Figure 10b that, after attack of the exposed surface 54 and elimination of the mask 53 a dual-level compartment 60 is formed in the surface 25 of the intermediate substrate 13, at the position of the exposed surface 54. The compartment 60 consists of the hollow 49, the depth of which has increased, and by a hollow 61 which replaces the last exposed surface 55 and which, on the one hand, rejoins the surface 25 via a new stair 63 and, on the other hand, rejoins the bottom of the hollow 49 via the stair 51, or intermediate stair, located substantially at the centre of the compartment 60.

Figure 11 shows the intermediate support 13 on which, and in particular in the compartment 60, the three thin films 14, 15, 16 have been deposited, these films being superposed as in the previous example and matching the shape of the stairs 63, 51, 50.

A subsequent operation consists in eliminating the parts of these thin films which are not contained in the compartment 60. As in the previous example, this can be obtained by a polishing operation which eliminates any

material protruding from the surface 25 of the intermediate substrate 13, this surface 25 being shown by a broken line in Figure 11.

As represented in Figure 12, the result of this polishing operation is that the surfaces S14 and S16 of the magnetic material films 14 and 16 located in the compartment 60 appear in the same plane as the surface 25. The nonmagnetic second thin film 15 separates these two magnetic films 14, 16, and this nonmagnetic second film 15 appears by its ends located at the stair 50 and the intermediate stair 51.

This has produced the intermediate assembly 12, which can be integrally joined to the host substrate 10 in the same way as in the previous example. Of course, unlike the previous case, in this version of the invention the shape of the magnetic poles P1, P2 is already etched in the magnetic films 14, 16.

Figure 13 shows the host substrate 10 integrally joined to the intermediate assembly 12 using the intermediate layer 22, and with the surfaces 25, S14, S15 oriented towards the host substrate 10, and the intermediate stair 51 substantially centred on the axis 21 of the notch 2. At this location, the nonmagnetic second film 15 forming [sic] a stair intended to constitute an air gap 73.

A subsequent step in the process of the invention consists in partially eliminating the intermediate support 13 as well as a part of the magnetic first film 14 located at the deepest level in the intermediate substrate 12, this deep magnetic film part being labelled 14P in Figure 13. Specifically, this operation removes any material located beyond a plane, represented by a broken line 70, which corresponds to a lower surface 71 of the first film 14 in the part where it is retained, that is to say on the opposite side from the surface S14; the result of this is that only a functional part 11b of the structure 11 is retained.

Figure 14 illustrates the result of this operation. It can be seen that the functional thin-film

structure part 11b is integrally joined to the host substrate 10 and that, unlike the previous version, the two magnetic poles P1, P2 are already formed, represented respectively by a part of the first film 14 and a part of the third film 16. The two poles P1, P2 are separated by a microscopic air gap 73 which results from the non-magnetic second film 15.

It can furthermore be seen that, in this version of the process of the invention, the magnetic poles P1, P2 are embedded between the remaining parts 13a, 13b of the substrate 13, so that the active surface is this time perfectly planar.

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CLAIMS

1. Process for making a device intended to form at least one magnetic head, the said device including a structure (11, 11a) of the deposited thin film type, the said deposited thin-film structure (11, 11a) including at least one deposited thin film (14, 15, 16) of magnetic material, the said structure (11, 11a) being supported by a host substrate (10), the process consisting in depositing the thin film (14, 16) on an intermediate substrate (13) in order to produce an intermediate deposited thin-film assembly (12), then in attaching the intermediate assembly (12) onto the host substrate (10) so as to join the latter integrally into the intermediate assembly (12), no thin film being deposited on the intermediate substrate when the latter is integrally joined to the host substrate, the process being characterized in that the latter step is carried out in such a way that the said thin film (14, 15, 16) is located on the side of the host substrate (10), and in that it consists in then at least partially eliminating the intermediate substrate (13) and in leaving only a functional part (11, 11b) of the intermediate assembly (12) to remain.

2. Process according to Claim 1, characterized in that it consists in integrally joining the intermediate assembly (12) and the host substrate (10) using an adhesive product forming an intermediate layer (22) between the intermediate assembly (12) and the host substrate (10), the intermediate layer (22) having a suitable thickness for compensating for irregularities or surface roughness defects on the host substrate (10).

3. Process according to Claim 1, characterized in that the host substrate (10) includes at least one magnetic circuit, and in that at least one thin film (14, 16) of magnetic material is deposited on the intermediate substrate (13) with a view to forming the magnetic poles (P1, P2).

4. Process according to Claim 3, characterized in that it consists in making at least one hollow (28) in

one face (25) of the intermediate substrate (13), then in depositing at least three superposed thin films (14, 15, 16) on the face (25) of the intermediate substrate (13) and in the hollow (28), the first film (14) which is in contact with the intermediate substrate (13) being a film of a magnetic material, the second film (15) deposited on the first being made of a nonmagnetic material, the third film (16) deposited on the second film being made of a magnetic material, the discontinuities between the face (25) and the hollow (28) constituting stairs (30, 30a), the shape of which is matched by the thin films, the process furthermore consisting in machining the intermediate assembly (12) on the side of the third film (16) so as to eliminate parts (16b, 16c) of the latter which lie outside the hollow (28), and optionally to eliminate peripheral parts 15b, 15c of the second, nonmagnetic layer which is located outside the hollow (28), so as to form a substantially plane face (32) and to cause at least one end (20, 20a) of the second film (15), located opposite a stair (30, 30a), to appear on this plane face, each end 20, 20a constituting an air gap which separates two magnetic films, one of which is formed by a part of the first film (14) and the other by a part of the third film (16), the intermediate assembly (12) being integrally joined to the host substrate (10) by the plane face (32).

5. Process according to Claim 4, characterized in that it consists, after having joined the host substrate (10) and the intermediate assembly (12) integrally, in machining the intermediate assembly (12) on the side opposite the host substrate (10), so as to eliminate the intermediate substrate (13) and a central part of the first magnetic film (14), this central part being located in the hollow (28), so that the remaining parts of the first and of the third magnetic films (14, 16) are in one and the same plane, and in that it consists in then etching the said remaining parts so as to form at least two magnetic poles (P1, P2) separated by an air gap (20, 20a).

6. Process according to one of the preceding claims, characterized in that in order to make the intermediate substrate (13), it consists in using a semiconductor material of monocrystalline type.

7. Process according to Claim 6, characterized in that the intermediate substrate (13) is made of silicon.

8. Process according to Claim 1, characterized in that it consists in making at the surface (25) of the intermediate substrate a dual-level compartment (60) formed by a first hollow (49) and a second hollow (61) which is shallower than the first, the two hollows being separated by an intermediate stair (51); the process consisting in then depositing on the compartment (60) a first, a second and a third thin film (14, 15, 16), respectively magnetic, nonmagnetic and magnetic; then in next eliminating any material protruding from the surface (25) of the intermediate substrate; then in fixing on the host substrate (10), via this surface (25), the intermediate assembly thus obtained; then in levelling a part of the intermediate substrate and of the first, magnetic film (14) so as to leave remaining from the intermediate assembly (12) only a functional part (11b) formed by a part of the first, magnetic film (14) and by a part of the third, magnetic film (16), these two magnetic films (14, 16) being separated by an air gap (73) consisting above the intermediate stair (51) of a residual part of the second, nonmagnetic film (15), the two magnetic film parts (14, 16) forming magnetic poles (P1, P2) embedded in the parts (13a, 13b) not eliminated from the intermediate substrate (13).