

The present invention relates to the thermo-optical recording of information. This recording technique is based on making use of a heat-sensitive structure with a reference surface within whose area are produced localised modifications of its optical characteristics. These modifications are optically readable and are the result of the interaction produced by a focussed laser beam which explores the reference surface and whose intensity is modulated in accordance with the information to be transcribed.

The thermo-optical recording technique offers the advantage of not needing any subsequent insolation treatment of the photo-sensitive surface, so that the heat-sensitive structure can be protected after manufacture by an envelope permeable to write and read radiation.

Moreover, the fact that reading can take place immediately after writing of the data makes it easy to exploit such an information carrier as a bulk memory with high information density.

Thermo-optical recording is based on the conversion into heat of as great a fraction as possible of incident radiated energy.

This assumes that one of the elements of the heat-sensitive structure is capable, under a very low thickness, of absorbing incident radiation. The heat given off by the impact of the optical beam is intended to produce the desired modification in optical characteristics by making use of the increase in temperature associated with the giving off of heat. For reasons of efficiency and resolution, the transitory heating must be confined to the immediate proximity of the centre of the impact zone of the writing beam. When the increase in temperature at the centre reaches a predetermined threshold value, it initiates the thermal phase proper of the writing process which can set off a phenomenon of ablation, coalescence, deformation or change in texture. In this way it becomes possible to optically differentiate the zones of the heat-sensitive structure where the thermal phenomenon has developed from those which have retained their original appearance.

The present invention concerns most particularly the deposition of a continuous metallic film, a few tens to a few hundreds of angstrom units thick, this layer constituting, in a heat sensitive structure, the collecting element for incident radiation where the emission of heat is located; it being possible to change the latter's form or texture because of its own transitory heating and/or the heating which it communicates to a subjacent element with which it cooperates. Typically, the optically absorbent metallic film can belong to a heat-sensitive structure comprising the formation of surface irregularities such as craters or bubbles, but also to structures with a practically smooth appearance, but where optical readability arises from an optically discernible change in texture.

Patent application FR-A-2474222 filed in France on 23 January 1980 under the number 80/01423 in the name of THOMSON-CSF, entitled "A PROCESS FOR THE THERMO-OPTICAL WRITING OF INFORMATION AND AN INFORMATION CARRIER INTENDED FOR THE IMPLEMENTATION OF THIS PROCESS" described a process of thermo-optical writing which consists of provoking, between an optically absorbent metallic layer and an organic sub-layer with low thermal diffusivity, a localised loss of adhesion at the point of impact of a writing beam. This loss of adhesion is associated with the emission of gas which, by expansion, produces deformation without rupturing the metallic layer. Patent application FR-A-2368779 filed in France on 22 October 1976 under the number 76 31 867 in the name of Thomson Brandt, entitled "AN INFORMATION CARRIER INTENDED FOR THE RECORDING OF INFORMATION AND A PROCESS FOR RECORDING INFORMATION ON SUCH A CARRIER" had described a structure with a similar double layer, but where the emission of gas could lead to the rupture of the metallic layer. Both these documents suggest making the deposition of the metallic layer by the Joule effect, that is, by evaporating metals such as gold and chromium in a high vacuum. American patent 4.414.273 suggests producing a heat-sensitive information carrier comprising a heat-sensitive metallic layer. It suggests a large number of metals which can be combined, including gold and chromium, and it refers to several deposition techniques with thicknesses of the order of

300 to 1500×10^{-10} m (300 to 1500 angstrom units). Sputtering and deposition in the vapour phase are mentioned in this document.

Since the aim of thermo-optically insulating an information carrier is to utilise the impact of a radiation beam to address a heat-sensitive zone, it is still necessary for the change in form or texture to produce a durable trace on the reference surface explored by the beam and for this trace to be as clear and fine as possible. The role of the metallic layer is therefore to absorb the radiation, to prevent heat spreading over the surface and, when the change in form or texture becomes apparent, to participate in the development of an imprint ensuring that accurate reading is possible in the short term, but also the long term.

In the knowledge that the thickness of a thin metallic layer is significant for fixing its absorbent properties and thermal diffusivity, it is important to determine the composition and technique of deposition that offers the best latitude of exposure, without losing sight of the sensitivity required, the manufacturing yield and the long-term stability of the heat-sensitive structure. In practice, for thicknesses of up to 300×10^{-10} m (300 angstrom units), efforts are made to obtain a high absorbing power together with low thermal diffusivity. Since it is tricky to measure thermal diffusivity, it may be deduced from other physical sizes which are specific mass and thermal conductivity. To characterise a metallic deposition in terms of thermal conductivity, qualitative use may be made of the knowledge of electric conductivity, since these two sizes are correlated and the second is easier to measure.

The technique of evaporation in a vacuum of a composition based on a precious metal and a metallic adjuvant to form a metallic film on the surface of an organic material was suggested in patent application FR-A-2474222, no. 80/01423, as constituting an appropriate element of structure for thermo-optical writing. The

gold cited as an example means that qualities of resistance to oxidation can be obtained.

The alloy $\text{Cr}_{20}\text{Au}_{80}$ (by weight) has made it possible to obtain, with thicknesses of 40 to 100 $\times 10^{-10}$ m (40 to 100 angstrom units), a high optical absorbing power and very appreciable qualities of hardness and ductility for engraving bubbles with an incident laser power of only 8 milliwatts. Evaporation in a vacuum does however present disadvantages.

Indeed, the crucible in which the metallic constituents are heated is governed by GIBBS phase rule such that the composition of the deposition has little relation to the contents of the crucible. Another disadvantage is linked with the kinetics of the metallic particles when approaching the base of the layer which means that sites occupied by the first particles adhering to the base have a tendency to capture the next particles, preventing them from giving rise to several nucleation points.

The result is a deposition in the form of crystalline aggregates with a relatively coarse texture which generally leads to a relatively low elastic limit. Moreover, deposition by evaporation in a vacuum tends to favour the existence of adjacent oxidised areas whose thickness is not negligible in relation to the overall thickness of the film deposited.

With a view to palliating these disadvantages, the invention provides for depositing on a carrier a film whose initial metallic constituents are arranged on a target. This target, placed facing the carrier, is subjected to intense ionic bombardment capable of conferring enough energy to the metallic atoms extracted from this target to develop a polycrystalline aggregate on the surface of the support, whose texture is noticeably finer than that produced by a deposition by evaporation in a high vacuum. This deposition by cathodic sputtering takes place under reduced pressure inside a vacuum chamber containing a rare gas. Magnetic means for confining the bombardment of the target are provided to allow collection of atoms as near as possible to the

target and thus favour the multiplication of nucleation sites which limits the growth of grains.

Such a deposition technique by cathodic sputtering with magnetic confinement means is already known from the work entitled "Handbook of thin film technology" Leon I. MAISSEL and Reinhard GLANG, 1970, McGraw Hill Book Company, pages 4-8, 4-9, 4-18 and 4-40.

The subject-matter of the invention is a process for making a thermo-optically writable information carrier of the type comprising a heat-sensitive structure suitable for the storage and optical reading of information, said structure being provided with a thin metallic layer which, by collecting the incident write radiation, produces transitory localised heating which, above a temperature threshold, creates a change in the optical characteristics of said heat-sensitive structure, said process comprising for this purpose the deposition of a polycrystalline aggregate in the form of a thin film which completely covers a reception surface of said structure, this deposition originating from an incident flow of particles of precious metal and a transition metal.

According to a first aspect of the invention, this process is characterised in that the metallic particles are extracted from a chromium target and a gold target exposed to bombardment by other particles confined by a magnetic field, which originate from electric discharge with a voltage of the order of 200 volts in argon under reduced pressure of the order of 10^{-3} torr (1 torr = 1.3 hPa) and in that the distance from the target to the reception surface is of the order of 18 to 20 cm, the reception surface collecting the metallic particles with a residual energy giving rise to an increased density of nucleation sites relative to that of a similar deposition by evaporation in a vacuum.

This process allows the manufacture of a metallic layer for a thermo-optically writable information carrier which is characterised in that this layer forms a polycrystalline aggregate comprising 35% of chromium and the rest of gold, the mean grain size of

which is of the order of 70×10^{-10} m (70 angstrom units), this layer being such that electron diffraction shows the characteristic rings of the face-centred cube structure of gold at low magnification.

According to a second aspect of the invention the aforementioned process is characterised in that the metallic particles are extracted from a chromium target partly masked by gold pellets, this target being exposed to bombardment by other particles confined by a magnetic field, which originate from electric discharge with a voltage of the order of 200 volts in argon under reduced pressure of the order of 10^{-3} torr (1 torr = 1.3 hPa), the distance from the target to the reception surface being of the order of 8 cm, and the reception surface collecting the metallic particles with a residual energy giving rise to an increased density of nucleation sites relative to that of a similar deposition by evaporation in a vacuum.

Such a process makes it possible to manufacture a layer which is characterised in that it forms a polycrystalline aggregate containing about 50 to 70% chromium, the rest being gold, this layer being such that electron diffraction shows diffuse rings, the mean grain size not exceeding 20×10^{-10} m (20 angstrom units).

According to a third aspect of the invention, the process indicated above is characterised in that the metallic particles are extracted from a cylindrical target consisting of chromium, its surface exposed to bombardment being partly covered with gold, this target being exposed to bombardment by other particles confined by a magnetic field aligned to the axis of the cylindrical target which originate from electric discharge with a voltage of the order of 200 volts in a rare gas under reduced pressure of the order of 10^{-3} torr (1 torr = 1.3 hPa), the reception surface, disposed parallel to the axis of the target, being at a distance from the latter of the order of 10 cm and collecting the metallic particles with a residual energy giving rise to an increased density of nucleation sites relative to that of a similar deposition by evaporation in a vacuum.

The invention also has as its subject-matter the information carrier obtained by the aforementioned process.

It will be easier to understand the invention by means of the following description and the attached figures in which:

- Figure 1 shows a cathodic sputtering frame for implementing the manufacturing process according to the invention,
- Figures 2 and 3 show variant embodiments of the frame of Figure 1,
- Figures 4 and 5 are explanatory diagrams relating to thin films according to the invention,
- Figure 6 is a sectional view of an information carrier according to the invention,
- Figure 7 is a plan of a fragment of film which has been subjected to thermo-optical writing.

Figure 1 shows the substrate 1 of an information carrier during the phase of depositing a thin metallic film. The substrate 1 is, for example, a disk permeable to write radiation, which has to receive on its face 3 a thin metallic deposition in order to absorb this radiation and obtain the giving off of heat. For this purpose, the disk 1 is mounted on a rotating support 2 with the reception surface 3 turned towards the base 5 of a cathodic sputtering frame. The cathodic sputtering frame comprises a cover 4 which, together with the base 5, forms a chamber similar to that of a vacuum evaporation frame. To produce the vacuum in the chamber, a connection has been provided with a tap 19 which is connected by a conduit 20 to a vacuum pump. Another connection is provided with a tap 17 which is connected to a gas supply conduit. The base 5 is fitted with a sealed electric bushing 6 of which the insulated lead of the base is connected to the negative pole 8 of an electricity supply 7. The positive pole 9 of the supply is connected to the base 5. Inside the chamber 4, 5 are provided two target supports 11 and 12 situated at a distance D from the surface 3 of the disk 1. Each target support 11 or 12 is carried on insulating carriers 10 resting on the base 5.

Two metal targets 13 and 14 are placed on the target supports 11 and 12 respectively and electrically connected to the insulated lead of the sealed bushing 6. The supply 7 is capable of developing an electric voltage V of a few hundreds of volts to ionise the gas contained in the cathodic sputtering chamber 4, 5. When this ionisation takes place, a current i of the order of one ampere is delivered by the supply 7.

The deposition to be made by cathodic sputtering has to be composed such that it has good qualities of resistance to oxidation. This is why one of the targets 13 or 14 consists of a precious metal such as gold.

The other target is made of a transition metal which serves as an adjuvant. The adjuvant metal is generally more oxidisable than the precious metal chosen. In the rest of the description, the composition of the metallic deposition is made of gold and chromium.

In contrast with the technique of evaporation in a vacuum which requires a very high vacuum and does not use electric discharge to extract the metallic particles, the present invention makes use of the bombardment of a target to extract the neutral atoms of the metals to be deposited, which makes it possible to produce a dosage based on the emitting surface of the targets, a process of geometric dosage which is much more flexible in use than that consisting of evaporating metals from heated crucibles. The electric discharge produced in the chamber 4, 5 follows a pumping operation which lowers the pressure in the frame to a value of the order of $2,7 \times 10^{-3}$ mbar ($2 \cdot 10^{-6}$ torr). During this preliminary operation, the tap 19 is open and the tap 17 is closed. To allow electric discharge with a low supply voltage of the order of 200 volts, the tap 17 is opened in order to introduce argon into the chamber 4, 5 and this supply of rare gas is regulated to reach a pressure of the order of 4×10^{-3} mbar ($3 \cdot 10^{-3}$ torr). Another gas can be added to the rare gas, such as hydrogen which has a substantial reducing effect which is useful for preparing the reception surface 3 to receive the metallic deposition. It

is known that with a high vacuum, the average free path of the evaporated particles can reach several metres. This is not the case for sputtering with a reduced pressure of argon of 10^{-3} mbar (10^{-3} torr), since the average free path of the particles from the target is of the order of 5 cm. Because of the more frequent collision of the metallic particles extracted with the gaseous atoms present between the targets 13 and 14 and the disk 1, a distance D of the order of 18 to 20 cm is adopted, which makes available particles whose residual kinetic energy means that a great density of nucleation sites can be ensured. In the case of evaporation in a vacuum, the distance D can be much greater since propagation takes place in a very rarefied atmosphere, but the energy on the approach to the substrate is too low to give rise to definite impacts as soon as the first nucleation sites are formed. The arriving particles come and replenish these sites without creating further ones, such that the deposition takes the form of a polycrystalline aggregate with a relatively coarse texture.

In order to ensure a good extraction yield and to limit the extent of the zone where the charged particles serving to bombard the targets 13 and 14 are situated, the invention provides that each target support 11, 12 is fitted with permanent magnets arranged so as to force the electrons bouncing off the target to return to it. This movement with an arc-shaped trajectory is illustrated in Figure 1 above the target 13. The neutral particles extracted 15 and 16 escape from this confinement by the magnetic field, but have sufficient kinetic energy to overcome the collisions they cannot fail to have with the filling gas. Confinement by a magnetic field favours the targets and the reception surface 3 of the disk being brought together without raising the latter to an exaggerated heat. The rotation of the disk 1 during the deposition of a metallic film contributes to the homogeneity of deposition and makes it possible to reduce the collection of heat. Deposition under a thickness e of 150×10^{-10} m (150 angstrom units) requires sputtering of gold and chromium for two minutes, which is perfectly satisfactory from the point of view of economy in an industrial manufacturing process.

By providing a waiting chamber for the disks, a good manufacturing yield can be achieved for deposited thicknesses of up to 200×10^{-10} m (200 angstrom units) and more. Examination under an electron microscope, at very great magnification, shows that a layer deposited with the frame of Figure 1, with a percentage of chromium of 35% by weight, has the appearance of a polycrystalline aggregate with an average grain size of the order of 70×10^{-10} m (70 angstrom units). The technique of electron diffraction makes it possible to discern the characteristic rings of the face-centred cubic structure of gold at a low magnification.

The crystal lattice of gold is slightly compressed by the presence of chromium in an interstitial solid solution.

A polycrystalline aggregate with superfine texture can be obtained by modifying the frame of Figure 1.

This variant is illustrated in Figure 2 where it can be seen that the distance from target to disk has been reduced by half. A chromium target 13 has been used whose surface subjected to bombardment has been partly masked by gold pellets 14. Thanks to this more compact configuration of the target, it has been possible to reduce the distance D' to 8 cm. Even at magnifications of the order of 300,000 to 500,000, with concentrations of chromium of 50 to 70%, a deposition texture can be observed where the grain boundary is not easy to situate, but which nevertheless allows their size to be put at something under 20 angstrom units. The electron diffraction figures show diffuse rings. For a sputtered composition with 60% chromium, a superfine texture can be observed with grains whose size is estimated at under 15 angstrom units.

Another variant frame illustrated in Figure 3 has given deposition results similar to those obtained with the arrangement in Figure 2. The use of a target 13 constituted by a chromium cylinder having gold strips 14 means that confinement can be produced with a magnetic field H aligned to the axis of the cylindrical cathode 13, 14.

This magnetic field is created outside the frame by an electromagnet whose winding 21 can be seen in Figure 3.

The reception surface 3 of the disk 1 is arranged parallel to axis of the cathode. The arc-shaped trajectory 22 illustrates the movement of the charged particles within the field H and the arrows pointing towards the disk 1 represent the movement of the metallic particles 15 and 16 of gold and chromium. This arrangement is conducive to deposition with masking which has a radial deposition zone producing a homogeneous film by rotation of the disk around the axis of the support 2. With a distance D' of the order of 10 cm, it is possible to produce a layer of 150×10^{-10} m (150 angstrom units) in twenty minutes when a delimiting mask is provided between the cathode and the surface 3 of the disk 1. It may be noted that the distance between the target and the collecting surface is substantially two times less by adopting the arrangements of Figures 2 and 3 compared with that adopted in the frame of Figure 1. This difference has an effect on the grain size which can partly be justified by the influence on the temperature of the substrate which plays a role in the nucleation and growth of thin films.

The depositions obtained by means of the cathodic sputtering frames which have just been described have been studied as concerns electric and optical properties. The depositions were made on glass and measurements of reflectivity R made with a beam passing through the substrate to reach the deposition. It is important to determine the electric resistance in ohms per square in order to assess the thermal resistivity of the films deposited.

The measurement results for a deposition of thickness $e = 150 \times 10^{-10}$ m (150 angstrom units) are set out in the diagram in Figure 4. The abscissa shows the composition by weight, a first number giving the percentage of gold and a second number the percentage of chromium, increasing from left to right. The solid line curves represent as a percentage the reflective power R_1 and the transmission power T_1 for a deposition made in the frame of

Figure 1. The reference curve r_1 indicates the resistance in ohms per square of this deposition. The optical measurements are made at the wavelength $\lambda = 632.8$ nm with an insufficient power to engender a change in optical characteristics.

The broken line curves referenced R_2 , T_2 and r_2 relate to a deposition of the same thickness made with the frame illustrated in Figure 2. No curves have been shown corresponding to a deposition made with the frame illustrated in Figure 3, since oxidation is not negligible when the deposition period changes from 2 to 20 minutes.

It can be seen from Figure 4 that directly above a 90/10 composition, that is, with more than 10% by weight of chromium, the curves R_1 and T_1 and the curves R_2 and T_2 oscillate little and are more or less symmetrical in relation to a horizontal line passing through the ordinate 20%. This result is quite remarkable, since it signifies that the absorbed fraction of incident optical radiation is 60% whatever the percentage of chromium between 10 and 100%. Another remarkable result concerns the curves r_1 and r_2 which peak at around the 60/40 composition. The resistance per square of the sputtered layers is perfectly reproducible since these layers benefit from good continuity and, for applications in the field of thermo-optical writing of data, the curves giving this resistance mean that very low thermal diffusivity can be expected which, coupled with high and constant absorbing power, means that an effective writing process can be envisaged, with little sensitivity to composition and well localised at the point of impact of the writing beam. At its peak, the $Au_{60}Cr_{40}$ composition is practically one order of magnitude higher than alloys of analogous composition.

To supplement the results in Figure 4, Figure 5 shows a diagram giving the performance of the optical parameters R , T and A as a function of the thickness e of the deposition.

The absorbing power A is given by the formula:

$$A = 100 - R - T$$

where R and T are the reflective and transmission powers in percentages.

The indices 1 and 2 relate to depositions with a 60/40 composition made with frames of Figures 1 and 2. The index 3 relates to a deposition with 50/50 composition made by evaporation in a vacuum.

It can be seen that the films obtained by cathodic sputtering are noted by an absorbing power A_1 or A_2 greater than the absorbing power A_3 of the evaporated deposition. It can also be observed that between 100×10^{-10} m (100 angstrom units) and 200×10^{-10} m (200 angstrom units), the absorbing power of the sputtered films is remarkably independent of the thickness e chosen. This signifies that the thickness parameter is not critical as concerns the opto-thermal yield of the film and that it makes it possible, in particular, to choose the reflective power between 15 and 30%, or between 10 and 30% with a superfine texture.

The explanation of these surprising results seems to be linked with the texture of the polycrystalline aggregates and/or the oxygen content, but it seems clear that reducing the distance separating the target from the reception surface (broken line curves in Figure 4) distinctly improves the efficiency and manufacturing latitude of depositions that can be used to produce heat-sensitive structures. When the deposition is carried out with a mixture of a rare gas and hydrogen as the filling gas, a diminution of reflectivity has been observed in the depositions. It is known in any case that hydrogen tends to become lodged in the joints of grains and that it is an efficient chemical reducer.

Figure 6 is a sectional view of a heat-sensitive structure using a deposited layer 24 according to the close cathodic sputtering process. One can start from a glass substrate 26, on the surface 27 of which a transparent sub-layer 25 is deposited the upper surface 3 of which has the role of a reception surface for the layer 24. The surface 3 can reproduce a pre-engraving relief.

Information can be written through the substrate 26 and the sub-layer 25 with a focussed optical beam 23 which penetrates the surface 28 of the substrate. This structure enables writing by ablation, but detachment can also be produced by localised degradation of the sub-layer 25 without breaking the metallic layer 3.

By subjecting depositions made by cathodic sputtering to thermo-optical writing, a change in the texture of the polycrystalline aggregate has been observed by examination under an electron microscope. Figure 7 shows the electron image of a minuscule fragment of sputtered layer 24 seen from the front, with a central zone S which has been subjected to transitory heating by irradiation with a laser beam. The neighbouring zones M have preserved the superfine texture which has been shown in detail on the left of Figure 7. On the other hand, it may be noted that the central irradiated zone S has a much coarser grain texture. This phenomenon, which is reminiscent of annealing apart from the fact that it is ultra-rapid, constitutes on its own a thermo-optical writing method, since the optical characteristics are modified by this change in texture. The fact of having a section with a coarser texture between the two sections with finer texture also represents pre-engraving since the elastic limit of the metallic deposition is influenced by the grain size. By re-exposure, this pre-engraving which serves as a guide for an optical writing beam will make it possible to write data either in the section S, or else in the adjacent sections M.

By studying the diffraction produced by the polycrystalline aggregates obtained by the close cathodic sputtering of a metallic composition of gold and chromium it has been possible to characterise the mesh parameters of the depositions.

For concentrations by weight of chromium of less than 50%, it is the gold lattice that is observed with the chromium atom in an interstitial solid solution, which compresses the gold lattice. With chromium concentrations in the range 50 to 60% (a concentration of 50% by weight of chromium is equal to an atomic concentration of 78%), the situation tends to be inverted and beyond

this range it is observed that the cube lattice of chromium is dilated by gold atoms in an interstitial solid solution. In the knowledge that the solubility limit by volume of chromium atoms in gold is close to 20%, thin films with a high gold content can be supersaturated with chromium up to a concentration of 40% chromium where this transition with a low atomic radius plays the role of a solute while compressing the crystalline mesh of the substrate. The extremes of the curves in Figure 4 seem linked to the inversion of the crystallographic structure which passes from the face-centred cube structure of gold to the cube structure of chromium beyond a concentration of chromium by weight equal to 40% (this concentration by weight equals an atomic concentration of 75%).

Furthermore, beyond a concentration of 15% chromium which is close to the limit of solubility by volume of chromium in gold, the evolution of optical properties is not noticeable compared to that of electrical properties. The optical parameters of the layer seem to be much more closely linked to chromium, in a broad composition range. Measurements of the optical absorbing power and the optical transmission power for range of wavelengths from 400 nm to 1200 nm confirm a general tendency towards the optical response of chromium, this being true for chromium contents by weight from 50% to 100%.

Of course, the invention is not limited to the case of a deposition on glass. The reception surface can be that of any inorganic or organic base material and can in particular be that of a sub-layer which improves the content or continuity of the deposition.



CLAIMS

1. A process for making a thermo-optically writable information carrier of the type comprising a heat-sensitive structure suitable for the storage and optical reading of information, said structure being provided with a thin metallic layer (24) which, by collecting the incident write radiation, produces transitory localised heating which, above a temperature threshold, creates a change in the optical characteristics of said heat-sensitive structure, said process comprising for this purpose the deposition of a polycrystalline aggregate in the form of a thin film (24) which completely covers a reception surface (3) of said structure, this deposition originating from an incident flow of particles (15, 16) of precious metal and a transition metal, characterised in that, to obtain a predetermined metallic composition, said metallic particles (15, 16) are extracted from a chromium target (13) and a gold target (14) exposed to bombardment by other particles confined by a magnetic field (H), which originate from electric discharge with a voltage of the order of 200 volts in argon under reduced pressure of the order of 10^{-3} torr (1 torr = 1.3 hPa) and in that the distance (D) from the target to the reception surface is of the order of 18 to 20 cm, the reception surface (3) collecting the metallic particles (15, 16) with a residual energy giving rise to an increased density of nucleation sites relative to that of a similar deposition by evaporation in a vacuum.
2. A process for making a thermo-optically writable information carrier of the type comprising a heat-sensitive structure suitable for the storage and optical reading of information, said structure being provided with a thin metallic layer (24) which, by collecting the incident write radiation, produces transitory localised heating which, above a temperature threshold, creates a change in the optical characteristics of said heat-sensitive structure, said process comprising for this purpose the deposition of a polycrystalline aggregate in the form of a thin film (24) which completely covers a recep-



tion surface (3) of said structure, this deposition originating from an incident flow of particles (15, 16) of precious metal and a transition metal, characterised in that, to obtain a predetermined metallic composition, said metallic particles (15, 16) are extracted from a chromium target (13) partly masked by gold pellets, this target being exposed to bombardment by other particles confined by a magnetic field (H), which originate from electric discharge with a voltage of the order of 200 volts in argon under reduced pressure of the order of 10^{-3} torr (1 torr = 1.3 hPa), the distance (D') from the target to the reception surface being of the order of 8 cm, and the reception surface collecting the metallic particles with a residual energy giving rise to an increased density of nucleation sites relative to that of a similar deposition by evaporation in a vacuum.

3. A process for making a thermo-optically writable information carrier of the type comprising a heat-sensitive structure suitable for the storage and optical reading of information, said structure being provided with a thin metallic layer (24) which, by collecting the incident write radiation, produces transitory localised heating which, above a temperature threshold, creates a change in the optical characteristics of said heat-sensitive structure, said process comprising for this purpose the deposition of a polycrystalline aggregate in the form of a thin film (24) which completely covers a reception surface (3) of said structure, this deposition originating from an incident flow of particles (15, 16) of precious metal and a transition metal, characterised in that, to obtain a predetermined metallic composition, said metallic particles (15, 16) are extracted from a cylindrical target (13) consisting of chromium, its surface exposed to bombardment being partly covered with gold, this target being exposed to bombardment by other particles confined by a magnetic field (H) aligned to the axis of the cylindrical target which originate from electric discharge with a voltage of the order of 200 volts in a rare gas under reduced pressure of the order of 10^{-3} torr (1 torr = 1.3 hPa), the



reception surface, disposed parallel to the axis of the target, being at a distance from the latter of the order of 10 cm and collecting the metallic particles (15, 16) with a residual energy giving rise to an increased density of nucleation sites relative to that of a similar deposition by evaporation in a vacuum.

4. A metallic layer for a thermo-optically writable information carrier, this layer being thin and intended to collect incident write radiation which produces transitory localised heating which, above a temperature threshold, creates a change in optical characteristics, this layer having the form of a deposition of polycrystalline aggregate in the form of a thin film (24) which completely covers a reception surface (3) and being made of a precious metal and a transition metal, characterised in that the content by weight of chromium exceeds the limit of solubility by volume in gold.
5. A metallic layer for a thermo-optically writable information carrier, this layer being thin and intended to collect incident write radiation which produces transitory localised heating which, above a temperature threshold, creates a change in optical characteristics, this layer having the form of a deposition of a polycrystalline aggregate in the form of a thin film (24) which completely covers a reception surface (3) and being made of a precious metal and a transition metal, characterised in that this layer forms a polycrystalline aggregate comprising 35% of chromium and the rest of gold, the mean grain size of which is of the order of 70×10^{-10} m (70 angstrom units), this layer being such that electron diffraction shows the characteristic rings of the face-centred cubic structure of gold at a low magnification.
6. A metallic layer for a thermo-optically writable information carrier, this layer being thin and intended to collect incident write radiation which produces transitory localised heating which, above a temperature threshold, creates a change in optical characteristics, this layer having the form of a



deposition of a polycrystalline aggregate in the form of thin film (24) which completely covers a reception surface (3) and being made of a precious metal and a transition metal, characterised in that this layer forms a polycrystalline aggregate containing about 50 to 70% chromium, the rest being gold, and this layer is such that electron diffraction shows diffuse rings, the mean grain size not exceeding 20×10^{-10} m (20 angstrom units).

7. A layer according to any of Claims 4 to 6, characterised in that its overall thickness is between 100 and 300×10^{-10} m (100 and 300 angstrom units).
8. A metallic layer according to any of Claims 4 to 7, characterised in that the chromium is in a solid solution in the gold.
9. A metallic layer according to any of Claims 4 to 7, characterised in that the gold is in a solid solution in the chromium.
10. A metallic layer according to any of Claims 4 to 9, characterised in that its grain texture is differentiated in its extent by pre-engraving heat treatment.