

Description

The invention relates to a method as described in the preamble of Claim 1, a packing as described in Claim 3, a method for operating a mould as described in Claim 4 and to a mould for carrying out this method, as described in Claim 5.

The encapsulating of components, for example semiconductor components, is a technique which, although well-developed, nevertheless still has many imperfections. A thermosetting epoxy synthetic resin with a high content of highly abrasive fillers is used for this encapsulating.

This starting material is extruded at a temperature of about 100° and then rolled; the rolled material is then cooled at ambient temperature and on cooling becomes hard and brittle. The cooled material is ground and/or chopped in a cutting mill to a certain fineness, the dust generated during this operation being drawn off by means of a suitable stream of air. Finally, the granulate thus obtained is deposited in containers and stored cooled.

When this material has to be used, it is first allowed to "acclimatise" slowly to room temperature; the material is then processed in accordance with the client's order to pills which each contain a quantity of material which is sufficient to encapsulate one or a certain number of components.

A number of these pills, again cooled, is then packed in a suitable container, during which operation care must be taken that the packing takes place in such a way that as little air as possible can enter. However, both during the shaping the pills and during the packing it is impossible to prevent a quantity of air nevertheless being present inside the pill and during injection of the material into the mould cavity this quantity of air will result in that the inflowing plastic acquires a foam structure. The gate must then be kept under pressure even after injection of the plastic in order to keep the occluded air compressed, which, however, demands a high closing pressure on the mould and gives rise to many problems in practice. Moreover, these pills are vulnerable and during the cooled transport thereof, during which the pills are frequently subjected to shocks and vibrations, damage occurs, as a result of which the quantity of material in a damaged pill will be smaller than the original amount. This gives rise to substantial problems during processing; the mould cavity is inadequately filled, while a damaged pill and/or a broken-off part thereof can block the pill feed mechanism in the automated casting equipment, so that break-downs occur which lead to refuse and loss of production.

Another drawback of the processing of the plastic material according to the prior part is that the slightly hygroscopic plastic material easily absorbs moisture deposited thereon during process-

ing, which has an adverse effect on the quality of the capsule finally obtained.

It is clear that the current method for production and processing of the epoxy material involving the numerous, frequently not completely controllable, steps is highly imperfect and these imperfections have a direct adverse influence on the quality of the end product.

The aim of the invention is to overcome all of these drawbacks. The method provided according to the invention is, to that end, carried out in the manner described in the characterizing clause of the main claim, a preferred embodiment of the method being described in Claims 2.

The advantages achieved with the invention are numerous and can be summarized as follows:

During manufacture, the units, which still contain fluid compound, have to pass through only a short cooling path since an effective energy transfer is possible. Manufacturing is dust-free and there is thus also no further loss of material due to unusable dust and/or particles which are too small.

No grinding or chopping operations are needed and the processing units, which are not exposed to abrasive effects, are simple. The surrounding air can no longer exert an adverse effect and influence by, and absorption of, moisture is precluded, as is occlusion of air. The entire, short manufacturing line has excellent manageability and controllability; the subsequent detection of faults is also much simpler.

Further advantages of the packing are that coding is possible, with all its attendant advantages, while the freedom in shaping offers the possibility of selecting a shape which permits a simple pre-warming before injection. The strip-shaped packing offers the possibility of providing positioning markings, which promotes a rapid and reliable treatment thereof in the automated encapsulating machine. When a breakdown arises in a specific automated machine, this particular machine can be stopped without problems, without causing a blockage elsewhere in the processing system. When faults occur, this coding possibility of the compound package enables these to be traced afterwards.

Finally, a great advantage is that a very constant and accurate metering of the encapsulating material is possible.

Storage is appreciably simpler and more favourable; when the packing is damaged, only a minimum number of units of base material will be lost. There is no longer any need to wait until the compound stored in the cooled state has reached room temperature before processing, as a result of which incorrect processing is excluded. Checking the stock of stored compound is very simple, while it is no longer necessary for the user himself to

produce the measured quantities of base material (as in the case of the pills) since transport and storage have become problem-free. The risk of crumbling, which is attendant when pills are used, no longer exists and there is likewise no danger that the homogeneity of the base material will be disturbed during distribution. Using the markings on the packing, it is possible to check whether the contents thereof correspond to what is indicated on the box.

Finally, great advantages are obtained during the processing of the material. The material no longer comes into direct contact with the injection mechanism; the highly abrasive fillers in the material are then also no longer able to damage this mechanism. Contamination of the injection machine will no longer occur and, consequently, no downtime for cleaning the machine will be necessary. When the injection has to be interrupted for any reason whatsoever before the entire packing has been pressed empty, the said packing can be removed without the injection mechanism having to be cleaned thereafter.

Since the variation in the quantity of material supplied is obtained by variation in the length of the packing, it is possible to supply the material in strips with an identical width for each unit quantity, as a result of which a universal feed mechanism can be used.

Since the bulge is in the injection channel during processing, all of the problems associated with loosening of the gate in the prior art are overcome. Since, moreover, the gate duct is no longer in contact with the lead frame, it is also possible to feed over the leads if desired; there is no longer any need to feed only via the corner in the case of certain shapes of encapsulations. Feeding can be effected without problems via the dividing plane of the mould, which appreciably simplifies mould construction.

The problems which arise in the state of the art when processing pills, such as leakage of the material to above the plunger with contamination and pressure loss, are, of course, completely absent.

Finally, the fact that the compound can be processed direct from cooling is a great advantage; the slow "acclimatization" of a closed package provided with a desiccant, such as is necessary with the state of the art, is dispensed with.

The invention is explained with the aid of the drawing, in which:

Figure 1 is a schematic representation of an installation for carrying out the method according to the invention;

Figure 2 is a schematic representation which illustrates a processing step in this method;

Figure 3 shows various configurations of the packing obtained using the method according to

the invention;

Figure 4 shows a top view of an individual packing; and

Figure 5 shows schematically the use of the packing obtained according to the invention in combination with an installation for encapsulating, for example, semiconductor components.

Figure 1 shows schematically an extruder 2 which supplies the thermosetting plastic material (also termed "compound") to be packaged; the material issuing from this extruder is indicated by 4. This material is injected into a thin-walled, flexible plastic covering which is formed from two plastic films 6a, 6b, the edges of which are sealed to one another by means of a sealing device 8, so that a thin flexible tube 10 forms. This tube, filled over its entire cross-section with the plastic material 4 with the exclusion of air, is pre-cooled by means of cold air supplied through the mouthpieces 11a, 11b, which are connected to a source, which is not shown, of cool air, and then flattened by two rollers 12a, 12b. The tube is driven by transport means, which are not shown, in the direction of the arrow 14 and beyond the rollers 12a, 12b passes a sealing device 16, which is shown in detail in the right-hand half of Figure 2. The individual packings 18a, 18b which are formed here and are still connected to one another are finally cooled by cold air supplied through the schematically indicated mouthpieces 19a, 19b and, combined in an elongated strip, are fed in the direction of the arrow 20 through a suitable transport device, indicated schematically by the two conveyor belts 24a, 24b.

Figure 2 shows the sealing device 16 with, drawn alongside, the strip 22 with the individual packings 18a, 18b, 18c obtained by sealing. By using a pair of seal electrodes comprising a plane bottom electrode 24 and a top electrode 26 in which a suitable rectangular, elongated recess 28 has been formed, each individual packing acquires a shape which consists of a rectangular body section 30 and a bulge 32 connecting thereon. When the front edge of this bulge 32 is cut off, an opening is formed from which the material present in the packing can flow out when pressure is applied to the body section 30.

The quantity of material present in each individual packing can be varied as desired by varying the length of the section of the flat-rolled tube which passes between two successive sealing operations of the sealing device 16.

Figure 3a shows a strip 22a with short individual packings 34a therein; Figure 3b shows a strip 22b with appreciably longer individual packings 34b. In-between sizes are shown at b, c and d.

Figure 4 shows a top view of a strip 40 with a packing 42, which here also consists of the body section 44 with the bulge 46. As Figure 4 shows,

several pieces of printed information, indicated by 48a-48e, are provided on the packing. Of these, printed information 48e is a so-called bar code which, as is known, can contain a great deal of information and according to the invention is advantageously used to ascertain whether the packing contains the correct material before the contents of the packing are fed to a mould, while 48f is a positioning marking, for example produced as a reflecting dot.

Figure 5 shows, very schematically, a mould with auxiliary equipment suitable for use in combination with the new packing according to the invention. In the conventional manner, the mould consists of the top half 60 and the bottom half 62; they are pressed against one another by means which are not shown and are symbolized by the arrows 64a, 64b, clamping a component, for example a semiconductor component 66, to be encapsulated. The quantity of material necessary for each individual "shot" is present in each of the packings supplied, a number of which are indicated by 68a..68d; they are supplied in the direction of the arrow 70. Each packing passes a bar code reader 72, which supplies an output signal corresponding to the bar code and which can be used, for example, to stop the installation when incorrect packings are supplied. The front edge 76 of the bulge 78 is cut off from each individual packing using a suitable cutting mechanism 74; after reaching the correct position at the mould, as indicated for the packing 68a, the bulge 78 lies in the injection channel 80 of the mould and, after exerting pressure on the body section of the packing by means of a device suitable for this purpose, indicated schematically by 82, the contents of the packing are pressed into the mould cavity 84.

Of course, many modifications in both use, design and configuration of the packings are possible within the framework of the claims. Thus, it is conceivable to shape packings which have a bulge at either end, so that packings of this type can be used in a double mould, two mould cavities being filled with plastic at the same time at each casting step. The shape of the body section can also be varied as desired and depending on the intended use.

Claims

1. A method of packing a measured quantity of thermosetting resin intended for encapsulating a component, in particular an integrated circuit, **characterised in that** this resin is supplied, under exclusion of the surrounding air, into a hollow cavity defined by two flexible walls which are interconnected at the boundary of said cavity, said boundary being provided with

an outflow spout which fits sealingly in the injection channel of a mould to protect the injection mechanism of a mould in which the packing is used against interaction with the resin.

2. Method according to claim 1, **characterised in that** the resin, supplied continuously by an extruder, is injected directly after issue, into a thin-walled flexible tube, the tube, thus formed, is flat-rolled to a predetermined thickness and the inner walls of this tube which are opposite to one another are brought together at positions with predetermined spacings, in such a way that two edge boundaries are formed which are located at a distance from one another and are transverse to the longitudinal edges of the tube, of which edge boundaries at least one is provided with a bulge which defines the outflow spout.
3. Packing for a measured quantity of thermosetting resin intended for encapsulating a component, in particular an integrated circuit, obtained using the method according to one or more of the preceding claims.
4. Method for operating a casting mould for encapsulating a component, in particular an integrated circuit, with thermosetting resin, which mould is provided for each mould cavity with an injection channel, connected to said cavity, using a packing containing a measured quantity of said resin with the exclusion of surrounding air, having flexible walls and an outflow spout which fits sealingly in the injection channel, said packing being emptied by exerting pressure on the remaining section thereof.
5. Mould carrying out the method according to claim 4, **characterised by** an injection channel for sealingly receiving the outflow spout of the packing as used and by means for exerting pressure on the remaining part of the packing.

Patentansprüche

1. Verfahren zum Verpacken einer bestimmten Menge hitzehärtbaren Harzes, die zum Einschließen einer Komponente, insbesondere eines integrierten Schaltkreises, bestimmt ist, dadurch gekennzeichnet, daß das Harz unter Ausschluß der es umgebenden Luft in einen hohlen Zwischenraum zugeführt wird, der von zwei flexiblen Wandungen gebildet wird, welche am Rand des Hohlraums miteinander verbunden sind, wobei dieser Rand zu einem Ausfluß geformt ist, der abdichtend in den Ein-



several pieces of printed information, indicated by 48a-48e, are provided on the packing. Of these, printed information 48e is a so-called bar code which, as is known, can contain a great deal of information and according to the invention is advantageously used to ascertain whether the packing contains the correct material before the contents of the packing are fed to a mould, while 48f is a positioning marking, for example produced as a reflecting dot.

Figure 5 shows, very schematically, a mould with auxiliary equipment suitable for use in combination with the new packing according to the invention. In the conventional manner, the mould consists of the top half 60 and the bottom half 62; they are pressed against one another by means which are not shown and are symbolized by the arrows 64a, 64b, clamping a component, for example a semiconductor component 66, to be encapsulated. The quantity of material necessary for each individual "shot" is present in each of the packings supplied, a number of which are indicated by 68a-68d; they are supplied in the direction of the arrow 70. Each packing passes a bar code reader 72, which supplies an output signal corresponding to the bar code and which can be used, for example, to stop the installation when incorrect packings are supplied. The front edge 76 of the bulge 78 is cut off from each individual packing using a suitable cutting mechanism 74; after reaching the correct position at the mould, as indicated for the packing 68a, the bulge 78 lies in the injection channel 80 of the mould and, after exerting pressure on the body section of the packing by means of a device suitable for this purpose, indicated schematically by 82, the contents of the packing are pressed into the mould cavity 84.

Of course, many modifications in both use, design and configuration of the packings are possible within the framework of the claims. Thus, it is conceivable to shape packings which have a bulge at either end, so that packings of this type can be used in a double mould, two mould cavities being filled with plastic at the same time at each casting step. The shape of the body section can also be varied as desired and depending on the intended use.

Claims

1. A method of packing a measured quantity of thermosetting resin intended for encapsulating a component, in particular an integrated circuit, characterised in that this resin is supplied, under exclusion of the surrounding air, into a hollow cavity defined by two flexible walls which are interconnected at the boundary of said cavity, said boundary being provided with

an outflow spout which fits sealingly in the injection channel of a mould to protect the injection mechanism of a mould in which the packing is used against interaction with the resin.

2. Method according to claim 1, characterised in that the resin, supplied continuously by an extruder, is injected directly after issue, into a thin-walled flexible tube, the tube, thus formed, is flat-rolled to a predetermined thickness and the inner walls of this tube which are opposite to one another are brought together at positions with predetermined spacings, in such a way that two edge boundaries are formed which are located at a distance from one another and are transverse to the longitudinal edges of the tube, of which edge boundaries at least one is provided with a bulge which defines the outflow spout.
3. Packing for a measured quantity of thermosetting resin intended for encapsulating a component, in particular an integrated circuit, obtained using the method according to one or more of the preceding claims.
4. Method for operating a casting mould for encapsulating a component, in particular an integrated circuit, with thermosetting resin, which mould is provided for each mould cavity with an injection channel, connected to said cavity, using a packing containing a measured quantity of said resin with the exclusion of surrounding air, having flexible walls and an outflow spout which fits sealingly in the injection channel, said packing being emptied by exerting pressure on the remaining section thereof.
5. Mould carrying out the method according to claim 4, characterised by an injection channel for sealingly receiving the outflow spout of the packing as used and by means for exerting pressure on the remaining part of the packing.

Patentansprüche

1. Verfahren zum Verpacken einer bestimmten Menge hitzehärtbaren Harzes, die zum Einschließen einer Komponente, insbesondere eines integrierten Schaltkreises, bestimmt ist, dadurch gekennzeichnet, daß das Harz unter Ausschluß der es umgebenden Luft in einen hohlen Zwischenraum zugeführt wird, der von zwei flexiblen Wandungen gebildet wird, welche am Rand des Hohlraums miteinander verbunden sind, wobei dieser Rand zu einem Ausfluß geformt ist, der abdichtend in den Ein-



spritzkanal einer Form paßt, um den Einspritzmechanismus einer Form zu schützen, bei welcher die Verpackung dazu benutzt wird, um eine Reaktion mit dem Harz zu verhindern.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das Harz, das kontinuierlich durch einen Extruder zugeführt wird, direkt nach dem Austritt in einen dünnwandigen biegsamen Schlauch eingespritzt wird, der so geformte Schlauch wird flachgewalzt auf eine vorbestimmte Dicke und die Innenwände dieses Schlauches, die einander gegenüberliegen, werden zusammengebracht auf Positionen mit vorbestimmten Abständen, derart, daß zwei Randkanten gebildet werden, welche in einer Entfernung voneinander angebracht und diagonal zu den Längskanten des Schlauches verlaufen, wobei zumindest eine dieser Randkanten mit einer Ausbuchtung versehen ist, die den Ausfluß definiert.
3. Verpackung für eine bestimmte Menge hitzhärtbaren Harzes, die zum Einschließen einer Komponente, insbesondere eines integrierten Schaltkreises, bestimmt ist, und die durch die Anwendung des Verfahrens gemäß einem der vorhergehenden Ansprüche erreicht wird.
4. Verfahren zum Betreiben einer Gießform zum Einschließen einer Komponente, insbesondere eines integrierten Schaltkreises, mit hitzhärtbarem Harz, wobei die Form für jeden Gießhohlraum mit einem Einspritzkanal versehen ist, verbunden mit diesem Hohlraum, unter Verwendung einer Verpackung, die, unter Ausschluß der Umgebungsluft, eine bestimmte Menge dieses Harzes enthält, mit flexiblen Wandungen und einem Ausfluß, welcher abdichtend in den Einspritzkanal paßt, wobei diese Verpackung dadurch geleert wird, daß Druck auf deren verbleibenden Abschnitt ausgeübt wird.
5. Form für das Verfahren nach Anspruch 4, dadurch gekennzeichnet, daß ein Einspritzkanal vorgesehen ist für das abdichtende Aufnehmen des Ausflusses der Verpackung wie sie verwendet wird und durch Mittel zum Ausüben von Druck auf den verbleibenden Teil der Verpackung.

Revendications

1. Méthode d'emballage d'une quantité mesurée de résine thermdurcissable destinée à l'encapsulation d'un composant, en particulier d'un circuit intégré, caractérisée en ce que cette

résine est fournie, en excluant l'air environnant, dans une cavité creuse définie par deux parois souples qui sont reliées sur la limite de ladite cavité, ladite limite étant pourvue d'une sortie d'écoulement qui s'adapte, d'une manière étanche, dans le canal d'injection d'un moule afin de protéger le mécanisme d'injection du moule, dans lequel on utilise l'emballage, contre une interférence avec la résine.

2. Méthode suivant la revendication 1, caractérisée en ce que la résine, distribuée en continu par une extrudeuse, est injectée, directement à sa sortie, dans un tube souple à paroi fine, le tube ainsi formé est aplati par laminage jusqu'à une épaisseur prédéterminée et les parois internes de ce tube, opposées l'une à l'autre, sont amenées en positions à des intervalles prédéterminés, de telle façon que soient formées deux bords limites qui sont situés à distance l'un de l'autre et qui sont transversaux par rapport aux bords longitudinaux du tube, dont au moins un des bords limites est muni d'une protubérance qui définit la sortie d'écoulement.
3. Emballage pour une quantité mesurée de résine thermdurcissable destinée à l'encapsulation d'un composant, en particulier d'un circuit intégré, obtenu en utilisant la méthode suivant l'une ou plusieurs des revendications précédentes.
4. Méthode pour faire fonctionner un moule de moulage destiné à l'encapsulation d'un composant, en particulier d'un circuit intégré, par de la résine thermdurcissable, le moule étant muni, à chaque cavité de moule, d'un canal d'injection relié à ladite cavité, en utilisant un emballage contenant une quantité mesurée de ladite résine, en excluant l'air environnant, ayant des parois souples et une sortie d'écoulement qui s'adapte, de manière étanche, dans le canal d'injection, ledit emballage étant vidé en exerçant une pression sur sa partie restante.
5. Moule mettant en oeuvre la méthode suivant la revendication 4, caractérisé par un canal d'injection pour recevoir, d'une manière étanche, la sortie d'écoulement de l'emballage utilisé, et par un moyen pour exercer une pression sur la partie restante de l'emballage.