STORAGE AND TRANSPORTATION DEVICE FOR STORING AND TRANSPORTING OPTICAL FIBER PREFORM AND PRECURSORS THEREOF

Inventors: Ajay Gupta, Aurangabad (IN); Parag Kulkarni, Aurangabad (IN)

Correspondence Address:
JAMES RAY & ASSOCIATES
2640 Pitcairn Road
Monroeville, PA 15146 (US)

Assignee: STERLITE OPTICAL TECHNOLOGIES LTD

ABSTRACT
A storage and transportation device for storage and transportation of a material comprising front surface and rear surface capable of being connected with each other through left surface and right surface suitable to form a vertical structure which in-turn is capable of being closed by bottom surface at its bottom end and by top surface at its top end to form a box type structure provided with an inlet towards its top end for supply of a gas to achieve desired environment inside the box structure and an outlet for the release of gas to achieve continuous flow of the gas thereby capable of removing all dust particles/foreign particles and environmental gases from the box structure before storing any material therein, and a filtration device for providing clean air before entry into box structure, and a holding—cum—hanging system to hold and hang the material being stored and transported.
> Dehydration
> Sintering
> Collapsing step

Figure 9
STORAGE AND TRANSPORTATION DEVICE FOR STORING AND TRANSPORTING OPTICAL FIBER PREFORM AND PRECURSORS THEREOF

FIELD OF THE INVENTION

[0001] The present invention relates to a storage and transportation device for storing and transporting optical fiber preform and precursors thereof. Particularly, the present invention relates to a device suitable for protecting the optical fiber preform and precursors thereof by isolating the same from dust particles/foreign particles and environmental gases.

BACKGROUND OF THE INVENTION

[0002] Optical fibers are inherently versatile as a transmission medium for all forms of information, be it voice, video or data. The primary object of telecommunication industry is to transmit greater amount of information, over longer distances, in shorter period of time. This object can be fulfilled with the optical fibers provided it has low optical attenuation loss and longer length.

[0003] The optical fibers for telecommunication are required to operate for longer distance means longer length optical fiber with fewer amplifiers and splices are the need of the time so that the cost involved in networking is reduced. As the requirement for optical performance of the optical fiber is stringent, the short length optical fiber needs to be eliminated. However, certain physical constraints in the process for producing fiber preform suitable for drawing the fiber can result in increase in probability of breakage of the fiber during the drawing step due to formation of certain physical defects in the preform itself, thus the fiber produced will be of shorter length than the required length. Therefore, the drawing of fiber has to be restarted from the preform which may, if there are more physical defects in the preform, break and hence result in wastage of the preform fiber.

[0004] In case the fiber does not break during the drawing stage, it is possible that due to the physical defects in the preform the fiber produced may have increased attenuation loss. As the requirement for optical performance of optical fibers is stringent, the source of attenuation loss in optical fiber also needs to be eliminated. However, certain physical constraints in the process for producing optical fiber preform, from which optical fiber is produced, can also result in increase in attenuation loss of the fiber produced.

[0005] The physical defects in the preform are observed due to contamination of the precursor materials, for example mandrel, glass tube or glass rod, and/or the intermediate materials, for example the soot porous body and/or hollow soot porous body during their storage and/or transportation from one manufacturing site to another manufacturing site. Even if the preform is stored before drawing the fiber there is every possibility that the preform may also get contaminated. Accordingly, the physical defects in the preform may also occur if the preform is stored before subjecting it to the fiber draw process. The contamination as referred herein means contamination of the precursor materials, and/or the intermediate materials, and/or the preform with dust particles and/or foreign particles and/or environmental gases from the environment in which the material is stored and/or transported. Therefore, the contamination of the preform is observed to result in short length optical fiber meaning thereby drawing process needs to be restarted, and hence increase in production cost and loss of productivity is observed. Further, the fiber produced may have higher attenuation loss meaning thereby wastage of overall process.

[0006] Therefore, if contamination of the precursor materials and/or preform with dust particles/foreign particles and environmental gases during their storage and transportation takes place it results in breaks in the fiber produced from such preform and may also result in increase in attenuation loss of the fiber produced from such preform.

[0007] Therefore, there is a need to have a storage and transportation device for storing and transporting optical fiber preform and precursors thereof which should be suitable for protecting the optical fiber preform and precursors thereof by isolating the same from dust particles/foreign particles and environmental gases meaning thereby should be suitable to provide the preform, precursor thereof or both without any contamination, and hence without any physical defects therein which in-turn avoids breakage of the fiber during drawing process and increase in attenuation loss in the fiber produced.

[0008] The prior art [U.S. Pat. No. 6,546,756] teaches a process for making an optical fiber with storage in a bag formed from a polyolefin-based material, wherein the polyolefin-based material includes a known anti-static additive.

[0009] The major limitation of the bag disclosed in US'756 is that it is suitable primarily only for glass precursor elements and the glass precursor elements being consolidated into glass rather than glass soot prior to being inserted into the bag. Therefore, the bag of US'756 can be used only to protect a material onto which soot deposition is to take place, such as for example, alumina and other ceramic mandrels, glass rods, core canes, or glass tubes, that is, only to protect a solid material and not any other precursors or intermediates, hollow soot porous body, etc. It is in fact suitable only for protecting complete and fully consolidated optical fiber performs which are ready for drawing step, meaning thereby it is not suitable for storage and transportation of the intermediates of process for manufacture of performs, that is not suitable for storage and transportation of hollow soot porous body, etc.

[0010] The another limitation of the bag disclosed in US'756 is that the anti-static material should be internal anti-static material, that is anti-static material should be mixed with the selected polymer prior to completion of manufacture of bag. For example, anti-static material should be added to the polymer during the extrusion process step itself in the selected amount. Therefore, a polymer bag made without internal anti-static material or without selected amount of the anti-static material cannot be used at all. In order to overcome this problem US'756 teaches that one may apply the anti-static material on the surface of the bag. However, US'756 also confirms that when applied to the surface such anti-static material could have residual material on the glass precursor being stored and transported.

[0011] Still another limitation of the bag disclosed in US'756 is that it is only suitable to minimize the possibility of accumulation of dust particles on the mandrel or fully consolidated preform which are ready to be drawn into an optical fiber stored and not suitable to avoid contamination of dust particles/foreign particles and environmental gases
onto the surface of the material stored, because there is no provision to create the desired environment.

[0012] Yet another limitation of the bag disclosed in US'756 is that after inserting the mandrel or fully consolidated preform which are ready to be drawn into an optical fiber required to be stored it has to be properly sealed either by way of a string device, such as drawstring, twist tie, rubber band, duct tape, or other clamping or securing device, which are not at all suitable to create air tight environment [a leak-proof seal]. In order to overcome this problem, US'756 teaches that one may merely tie the knot to substantially close the bag to outside atmosphere. It is well known that to have air tight knot, one has to be skilled enough to do so. Generally it is not possible to achieve air tight knot. In order to overcome this problem, US'756 further teaches that one may heat seal both the ends of the bag using heat sealing device meaning thereby the process of manufacturing the preform, and storing and transporting the same will have one additional process step of heat sealing which not only adds on to the overall process time, but also adds onto the overall cost of the process. Further, the storing and transportation floor should additionally have heat sealing device. In order to achieve the air tight environment [a leak-proof seal], one will have to be very careful full during heat sealing both the ends of the bag so as to avoid melting of the bag itself. It has been observed that the labour available on the storing and transportation floor is not that skilled which can perform heat sealing of both ends of the bag while saving, not only, the bag from getting damaged but also the material stored getting damage during heat sealing process step. Therefore, in order to avoid damage of the expensive bag and the material stored therein, the storing and transportation floor should also have skilled labour meaning thereby additional cost to the overall process.

[0013] The bag disclosed in US'756 consists of a polymer material, therefore, it is not suitable for storing and transporting a soft material such as hollow soot porous body, etc. which are more likely to get damaged during slight jerk during the transportation. The US'756 confirms that the bag should not contain any metallic components, because according to the teachings of US'756, a metallic components act as nucleation sites for crystallization, e.g. formation of crystallite within the silica glass.

[0014] Further limitation and drawback of the bag disclosed in US'756 is that the material, for example mandrels, soot porous bodies, hollow soot porous bodies, preform etc. stored therein and being transported therein is more likely to get physical defects in its body particularly during the transportation.

[0015] Still further limitation and drawback of the bag disclosed in US'756 is that it is suitable for storage and/or transportation of one material or one preform at a time and cannot store and transport more than one material at a time, that is it is not even suitable for storing and transporting more than one mandrel, preform etc.

NEED OF THE INVENTION

[0016] Therefore, the need of time is to have a storage and transportation device for storing and transporting optical fiber preform and precursors thereof which should be suitable for protecting the optical fiber preform and precursors thereof by isolating the same from dust particles/foreign particles and environmental gases meaning thereby should be suitable to avoid any contamination with dust particles/foreign particles and environmental gases of the preform, precursor thereof or both, and hence should be able to avoid the physical defects therein which in-turn avoids breakage of the fiber during drawing process and increase in attenuation loss in the fiber produced, and to overcome limitations, drawbacks and disadvantages of the prior art as described herein.

OBJECTS OF THE INVENTION

[0017] Accordingly, the main object of the present invention is to have a storage and transportation device for storing and transporting optical fiber preform and precursors thereof which is suitable for protecting the optical fiber preform and precursors thereof by isolating the same from dust particles/foreign particles and environmental gases meaning thereby is suitable to avoid contamination with dust particles/foreign particles and environmental gases of the preform, precursor thereof or both, and hence is able to avoid the physical defects therein meaning thereby avoids breakage of the fiber during drawing process and increase in attenuation loss in the fiber thus produced, and also overcomes limitations, drawbacks and disadvantages of the prior art as described herein.

[0018] Another object of the present invention is to have a storage and transportation device which can overcome the limitations and drawbacks of the prior art as described herein above, particularly, which is not only suitable for alumina and other ceramic mandrels, glass rods, core canes, or glass tubes, and completed and fully consolidated preform, but is also suitable for storage and transportation of the glass precursor elements, intermediates of the process for producing the preform, that is even suitable for storage and transportation of hollow soot porous body. Accordingly the object of the present invention is to provide a storage and transportation device which is not only suitable to protect a solid material, but also any other precursors or intermediates of process for manufacture of preforms, such as hollow soot porous body, etc.

[0019] Still another object of the present invention is to have a storage and transportation device wherein the anti-static material can be applied externally, that is the anti-static material need not be mixed with the selected material of the storage and transportation device prior to its manufacturing, and still leaving no residual material on the glass precursor being stored and transported therein.

[0020] Yet another object of the present invention is to have a storage and transportation device which is not only suitable to minimize the possibility of accumulation of dust particles/foreign particles on the mandrel or fully consolidated preform which are ready to be drawn into an optical fiber stored, but is also suitable to avoid contamination of dust particles/foreign particles and environmental gases onto the surface of any material stored therein and being transported therein.

[0021] This is an object of the present invention to have a storage and transportation device wherein after inserting any material including the mandrel or fully consolidated preform which are ready to be drawn into an optical fiber there is no need to have a seal by means of string device, such as drawstring, twist tie, rubber band, duct tape, or other clamping devices.
ing or securing device, which are known not to create air tight environment or a leak-proof seal. Further, there is no need to tie a knot to close the device to outside atmosphere meaning thereby there is no need to have a skilled labour for tying a knot. Further, there is no need to additionally have heat sealing device meaning thereby there is no need to have one additional process step of heat sealing during the process of manufacturing the preform, and storing and transporting the same, and therefore, there is no need to have add-on process time, add-on cost of the process and add-on cost of skilled labour on the storing and transportation floor. Accordingly, the present invention aims at providing a storage and transportation device wherein there is no need of heat sealing of any end thereof by any heat sealing device employing any skilled labour meaning thereby there is no risk of damage of storage and transportation device itself and of the material stored therein, and therefore there is a saving on the time and cost of the overall process.

[0022] This is another object of the present invention to have a storage and transportation device which, as stated herein is suitable for storing and transporting a soft material such as hollow soot porous body, etc., that is which is suitable of avoiding any damage during the transportation of the stored material.

[0023] This is still another object of the present invention to have a storage and transportation device which itself does not leave behind any contamination of dust particles, foreign particles, environmental gases, etc. on the surface of the preform or its precursors during the storage and transportation therein, and hence the material stored and transport remains free of contamination of dust particles, and/or foreign particles and/or environmental gases and suitable for producing a fiber having low attenuation loss.

[0024] This is yet another object of the present invention to have a storage and transportation device which does not cause any physical defects in body of the material, for example mandrels, soot porous bodies, hollow soot porous bodies, preform etc. when stored therein and/or when being transported therein meaning thereby which is suitable to store and transport not only the mandrels and performs, but also to store and transport any material including soot porous bodies, hollow soot porous bodies, etc. and at the same time being suitable to avoid formation of any physical defects in or on the body of the material stored and/or being transported therein, particularly during the transportation.

[0025] Yet another object of the present invention to have a storage and transportation device which is suitable for storage and transportation of more than one material at a time, that is suitable for storage and transportation of more than one material, mandrel, soot porous body, hollow soot porous body, preform etc.

[0026] The other objects and advantages of the present will be apparent from the following description when read in conjunction with the accompanying drawings which are incorporated for illustration of preferred embodiments of the present invention and are not intended to limit scope thereof.

BRIEF DESCRIPTION OF THE ACCOMPANYING FIGURES

[0027] FIGS. 1a and 1b show schematic representation of storage and transportation device in accordance with one of the preferred embodiments of the present invention.

[0028] FIG. 2 shows a schematic representation of storage and transportation device in accordance with preferred embodiment of the present invention.

[0029] FIG. 3 shows a schematic representation of storage and transportation device in accordance with another preferred embodiment of the present invention.

[0030] FIG. 4 shows a schematic representation of handling and hanging means of the storage and transportation device in accordance with preferred embodiment of the present invention.

[0031] FIG. 5 shows a schematic representation of deposition process over a mandrel to produce a soot porous body.

[0032] FIG. 6 shows a schematic representation of hollow soot porous body having centerline therethrough after removal of mandrel from the soot porous body.

[0033] FIG. 7 shows a schematic cross-sectional view of hollow soot porous body having centerline therethrough after removal of mandrel from the soot porous body.

[0034] FIG. 8 shows a schematic representation of hollow soot porous body in side the sintering furnace after removal of mandrel from the soot porous body.

[0035] FIG. 9 shows a hollow soot porous body having centerline therethrough after removal of mandrel from the soot porous body which is subjected to steps of dehydration, sintering and collapsing to produce a solid glass preform.

BRIEF DESCRIPTION OF THE INVENTION

[0036] It is apparently clear from the foregoing description that the storage and transportation device as known in the prior art suffers from various limitations, drawbacks and disadvantages as herein described.

[0037] The prior art device as herein above described has been observed to have limitation of not being suitable for storage and transportation particularly of soft materials, such as precursor materials, and intermediate materials, such as soot porous bodies, hollow soot porous bodies, etc., which are yet to be processed for preparing the preform.

[0038] Further, the known device has been observed to cause damages to the material stored therein during storage and transportation even on a slight jerk, and such problem is observed not only when material is soft and intermediate material, for example soot porous bodies, hollow soot porous bodies, etc., but also when the material is one of mandrels and performs.

[0039] Further, the known device has been observed to have limitation of not being suitable to achieve air tight [leak proof] environment to avoid contamination of the material stored therein or being transported therein with environmental particles and gases during storage and transportation.

[0040] It is known that contamination of the preform precursor materials or of soot porous bodies, hollow soot porous bodies, etc. with environmental particles and gases during storage and transportation, and any physical damage or defects caused in the body of the mandrel, soot porous bodies, hollow soot porous bodies, etc. during the storage and/or transportation is more likely to cause breakage of the fiber during drawing process and may increase in attenuation loss in the fiber produced.
Therefore, in accordance with the present invention there is provided a storage and transportation device for storing and transporting optical fiber preform and precursors thereof while protecting the optical fiber preform and precursors thereof from being isolated from dust particles/foreign particles and environmental gases meaning thereby avoids any contamination of the preform, precursor thereof or both with dust particles/foreign particles and environmental gases, and hence avoids formation of physical defects therein meaning thereby avoids breakage of the fiber during drawing process and increase in attenuation loss in the fiber thus produced, and also overcomes certain limitations, drawbacks and disadvantages of the prior art as described herein.

Accordingly, the present invention relates to a storage and transportation device for storage and transportation of a precursor material and/or intermediates and/or end products of the process for preparation of optical fiber preform and fiber therefrom comprising front surface and rear surface capable of being connected with each other through left surface and right surface suitable to form a vertical structure which is, in turn, capable of being closed by bottom surface at its bottom end and by top surface at its top end to form a box type structure, which in accordance with the present invention, is provided with an inlet towards its top end for supply of a gas to achieve desired environment inside the box structure and an outlet for the release of gas to achieve continuous flow of the gas, and a filtering means for purification of air before entry into box structure, and a holding—cum—hanging means to hold and hang the material being stored and transported.

In accordance with preferred embodiment of the present invention, inner sides of one or more surfaces of the box type structure are provided with coating of anti-static material. In accordance with one of the preferred embodiments of the present invention, inner sides of all surfaces of the box type structure are provided with coating of anti-static material.

The other embodiments of the present will be apparent from the following description when read in conjunction with the accompanying drawings which are incorporated for illustration of preferred embodiments of the present invention and are not intended to limit scope thereof.

DETAILED DESCRIPTION AND PREFERRED EMBODIMENTS OF THE INVENTION

FIGS. 1a and 1b show exemplary embodiments to illustrate storage and transportation device in accordance with the present invention for storage and transportation of a precursor material and/or intermediates and/or end products of the process for preparation of optical fiber preform and fiber therefrom.

In accordance with preferred embodiment of the present invention, the storage and transportation device comprises front surface 201 and rear surface 202 capable of being connected with each other through left surface 203 and right surface 204 suitable to form a vertical structure which is capable of being closed by bottom surface 205 at its bottom end and by top surface 206 at its top end to form a box type structure 200, which in accordance with present invention, is provided with an inlet 207[FIG. 1a] towards its top end for supply of a gas, preferably an inert gas to achieve desired environment inside the box structure 200 and an outlet 208[FIG. 1a] for the release of gas to achieve continuous flow of the gas thereby being capable to remove all dust particles/foreign particles and environmental gases from the box structure 200 before storing/removing any material therein, and a filtering means 209 for providing clean air before entry into box structure 200, and a holding—cum—hanging means 210 to hold and hang the material being stored and transported.

In accordance with preferred embodiment of the present invention, inner sides of one or more surfaces selected from the group comprising front surface 201, rear surface 202, left surface 203, right surface 204, bottom surface 205 and top surface 206 of the box type structure 200 are provided with coating of anti-static material.

In accordance with one of the preferred embodiments of the present invention, inner sides of all surfaces front surface 201, rear surface 202, left surface 203, right surface 204, bottom surface 205 and top surface 206 of the box type structure 200 are provided with coating of anti-static material.

In accordance with present invention, the outlet 208 for release of gas and clean air is same or different, preferably same.

In accordance with preferred embodiment of the present invention, the filtering means 209 is preferably hepa filter 209 provided preferably on inner side of the top surface 206 of the device 200. The filtering means 209 is provided with an inlet 210 for supply of air in the box type structure 200.

In accordance with preferred embodiment of the present invention, the holding—cum—hanging means 210 [FIGS. 2, 3, 4] is suitable for holding and hanging any material including precursor material, mandrels, hollow soot porous bodies, soot porous bodies and performs or combination thereof 211, 212, 213, 214[FIG. 4].

In accordance with one of the preferred embodiments of the present invention, the holding—cum—hanging means 210 consists of horizontal plates 215 and 216 connected by vertical means 217[FIG. 4] and is provided preferably in the center of the box structure 200. In accordance with one of the embodiments of the present invention, the holding—cum—hanging means 210 are fixed to the inner side of the bottom surface 205 for achieving stability during the transportation. The horizontal plates 215 and 216 are provided with circular means 220. The circular means 220 are optionally provided with clipping means 221 to hold the stored material. Preferably, the circular means 220 provided in upper horizontal plate 215 are provided with clipping means 221 to hold the stored material by its top end.

In accordance with one of the preferred embodiment of the present invention, the front face 201 acts as door and is capable of opening and closing as and when required and is provided with a seal [not shown in figure] to create air-tight seal, and is preferably provided with a handle 218 for ease of opening and closing and glass window for examination of material stored in the system.

The soot porous body can be prepared by any method known in the art. For example, by atmospheric chemical vapour deposition [ACVD] method. In accordance
with a typical process to manufacture a preform, as for example illustrated in FIG. 5, the preparation of soot porous body 1 comprises the following steps. The glass-forming precursor compounds are oxidized and hydrolyzed to form porous silica based materials 2. The porous silica based materials 2 are deposited on a tapered cylindrical member referred as mandrel 3 which was stored in the storage and transportation device of the present invention, which can be any commercially available mandrel with or without any specific preparation, preferably with specific preparation to remove the contaminants therefrom which is provided with a handle rod 4 and fitted on a lathe 5 to form soot porous body 1.

[0055] During the step of deposition, the mandrel 3 is rotated in a direction as illustrated by an arrow 6 and also moved along its length with reference to burner 7 to deposit the soot particles 2 on the mandrel 3 for producing soot porous body 1. During the deposition process, the dopant chemicals for example GeCl₄ may also be deposited to form the core of the preform and later the dopant chemicals may be terminated to form clad of the preform. The amount of deposition of the clad region 11 and core region 10 is achieved to have any desired ratio diameter of clad region 11 to the diameter of core region 10.

[0056] After completion of deposition, the soot porous body 1 is removed from lathe 5 along with mandrel 3 and handle rod 4, and the soot porous body 1 along with mandrel 3 and handle rod 4 is stored inside the storage and transportation device of the present invention before the mandrel removal step. During the mandrel removal step, the soot porous body 1 is removed from the presently disclosed device and thereafter the mandrel 3 is detached from the soot porous body 1 thereby resulting in formation of a hollow cylindrical soot porous body 8 (herein after referred to as hollow soot porous body) having a centerline 9 therethrough [FIG. 6].

[0057] It has been observed upon examination of the centerline 9 of the hollow soot porous body 8 obtained after removal of the mandrel, which was earlier stored and transported in the storage and transportation device of the present invention, is free from contaminants such as dust particles/foreign particles and also the defects or physical damages which could have been caused by an ordinary mandrel not stored and/or transported in the presently disclosed storage and transportation device.

[0058] The hollow soot porous body 8 thus formed comprises a core region 10 having a centerline hole 9, which, as stated herein, is observed to be free from contaminants such as dust particles/foreign particles and also from the damages and defects, which could have been caused due to defective mandrel, and a clad region 11 of the optical fiber preform, and said core region 10 has refractive index greater than that of the clad region 11 [FIG. 7].

[0059] After detachment of mandrel 3 a centerline 9 free from contaminants, damages and defects is created inside the soot porous body 1.

[0060] In accordance with present invention, the hollow soot porous body 101 may be stored in the presently disclosed storage and transported device before transferring it to the sintering furnace 100 or before transporting it to another site where sintering furnace is placed.

[0061] Now referring to accompanying FIG. 8, the prepared hollow soot porous body 101 is transferred to the sintering furnace 100 in order to achieve dehydration, and sintering of the hollow soot porous body 101.

[0062] In accordance with present invention, the dehydrated and sintered hollow glass body may be stored in the presently disclosed storage and transported device before transferring it to the collapsing furnace (not shown) or before transporting it to another site where collapsing furnace is placed for carrying out the collapsing of the centerline. The collapsing step can be performed separately in collapsing furnace or during the sintering step in sintering furnace 100.

[0063] The dehydrated and sintered hollow glass body is subjected step of collapsing of the centerline 102 to form a solid glass preform 103 [FIG. 9] with or without requiring any step of drilling or grinding or etching of the centerline 9/102 before steps of consolidation and collapsing, preferably without requiring any step of drilling or grinding or etching of the centerline 9/102 before steps of consolidation and collapsing, if the mandrel is the one which was stored and transported in the storage and transportation device of the present invention and was preferably subjected to specific preparation method before subjecting to step of deposition.

[0064] Thus, the prepared hollow soot porous body 101 is dehydrated, sintered and collapsed to convert it into solid glass preform 103 thereby making the present process not only highly time saving, but also highly economical for commercial applications.

[0065] In accordance with present invention, the solid glass preform 103 may be stored in the presently disclosed storage and transported device before transferring it to draw furnace or before transporting it to another site where draw furnace is placed for drawing the fiber.

[0066] In one embodiment, the hollow soot porous body 101, one end of which is provided with a plug 116 is inserted inside the furnace 100 with the help of the handle rod 106. The driving mechanism (not shown) facilitates lowering of the hollow soot porous body 101 into the furnace 100. The furnace 100 comprises a glass muffle tube 110 having a diameter sufficient to accommodate the preform 101 and to adequately provide the environment necessary for dehydration, sintering and collapsing. The muffle tube 110 is heated to temperatures necessary for dehydration and simultaneous sintering and collapsing process steps with the heating means (not shown) that is fitted to the sintering furnace 100.

[0067] The heating means selected may be suitable to create three heat zones inside the muffle tube 110 over a length. A thermocouple (not shown) provided in the furnace 100 measures the temperature of the hot zones inside the furnace created by the heating means, and the data measurement is fed to the temperature controller (not shown) that controls the temperature inside the muffle tube 110.

[0068] The furnace 100 is provided with an inlet port 115 located suitably on the furnace, preferably near the bottom of the muffle tube 110 for inserting desired gases in the furnace. The top end of the muffle tube 110 is closed with the lid 113 to achieve the preferred temperature profile inside the muffle tube 110 and to maintain the same during the dehydration, and simultaneous sintering and collapsing pro-
cess steps, and to avoid leakage of gases from the muffle tube 110 to the outside environment. A suction port 114 is suitably provided near the top of muffle tube 110 to facilitate evacuation of the gases from the muffle tube 110 as and when required or on completion of the process.

[0069] It has been observed upon examination of the dehydrated and sintered hollow glass body obtained from the hollow soot porous body 101, which was earlier stored and transported in the storage and transportation device of the present invention, is free from contaminants such as dust particles/foreign particles and environmental gases and also the defects or physical damages which could have been caused by an ordinary hollow soot porous body not stored and/or transported in the presently disclosed storage and transportation device.

[0070] It has also been observed upon examination of the solid glass preform 103 obtained by collapsing from the dehydrated and sintered hollow glass body, which was earlier stored and transported in the storage and transportation device of the present invention, is free from contaminants such as dust particles/foreing particles and environmental gases and also the defects or physical damages which could have been caused by an ordinary dehydrated and sintered hollow glass body not stored and/or transported in the presently disclosed storage and transportation device.

[0071] It has also been observed upon examination of the fiber obtained from the solid glass preform 103, which was earlier stored and transported in the storage and transportation device of the present invention, is free from contaminants such as dust particles/foreign particles and environmental gases and also the defects or physical damages which could have been caused by an ordinary solid glass preform not stored and/or transported in the presently disclosed storage and transportation device.

[0072] The above observations at every stage of the process for producing the fiber confirm that the mandrel, the hollow soot porous body, the dehydrated and sintered hollow glass body and solid glass preform are free from contaminants such as dust particles/foreign particles and environmental gases and also the defects or physical damages meaning thereby are suitable for producing a flawless preform when the mandrel, the hollow soot porous body, the dehydrated and sintered hollow glass body and solid glass preform are stored and transported in the storage and transportation device of the present invention, and also confirm that the preform is free from contaminants such as dust particles/foreign particles and environmental gases and also the defects or physical damages meaning thereby is suitable for producing a flawless fiber and reduced breakage of fiber during drawing when the preform is stored and transported in the storage and transportation device of the present invention, and hence, the overall process for producing a flawless preform, flawless and reduced breakage of fiber produced therefrom has been observed to be not only highly time saving, but also highly economical for commercial applications.

[0073] Further, it is apparent from the foregoing description and above observations, that the presently disclosed device has overcome limitations and drawbacks of the prior art, that is it is not only suitable for alumina and other ceramic mandrels, glass rods, core cans, glass tubes and solid glass preform, but is also suitable for glass precursor elements and the glass precursor elements to be consolidated into glass, for example for soot porous body and hollow soot porous body, that is, not only to protect a solid material, but also to protect any other precursors or intermediates.

[0074] In accordance with the present invention, the presently disclosed device has been observed to be suitable for any anti-static material even if it is provided with external anti-static material which can be selected from conventionally available anti-static materials, that is, the anti-static material need not be mixed with the selected material for constructions of the device prior to its manufacture.

[0075] In accordance with present invention the anti-static material can be applied on one or more surfaces 201, 202, 203, 204, 205 and 206 of the device 200, and it has been observed that external application of the anti-static material does not leave any residual material on the glass precursor being stored and transported.

[0076] Further, it has also been observed that the presently disclosed device is not only suitable to eliminate the possibility of accumulation of dust particles/foreign particles on the stored material, but is also suitable to eliminate the possibility of contamination of the stored material with environmental gases.

[0077] The presently disclosed device has also been advantageously found to be suitable to provide convenient and immediate seal to completely isolate the stored material from the dust particles/foreign particles and environmental gases meaning thereby it not only avoids any exposure of the stored material to the dust particles/foreign particles and environmental gases, but also avoids requirement of a string device, such as drawstring, twist tie, rubber band, duct tape, or other clamping or seaming device, which are not all suitable to create air tight environment [a leak-proof seal] and avoids need to tie the knot to substantially close the device to outside atmosphere, and avoids need to have heat seal the open ends, and hence, also avoids requirement of additional skilled manpower and additional heat seal means.

[0078] It has been surprisingly observed that the presently disclosed device cannot only be made from a polymer material, but can also be made from a metallic material, preferably aluminum sheet.

[0079] The presently disclosed device has also been advantageously found to be suitable for storage and/or transportation of more than one material or more than one preform at a time.

[0080] The presently disclosed system has been described with reference to ACVD method. However, it is suitable even for storing and transporting the materials of all other known methods for manufacturing optical performs and fibers.

1. A storage and transportation device for storage and transportation of a material comprising front surface and rear surface capable of being connected with each other through left surface and right surface suitable to form a vertical structure which in-turn is capable of being closed by bottom surface at its bottom end and by top surface at its top end to form a box type structure provided with an inlet towards its top end for supply of a gas to achieve desired
environment inside the box structure and an outlet for the release of gas to achieve continuous flow of the gas thereby capable of removing all dust particles/foreign particles and environmental gases from the box structure before storing any material therein, and a filtration means for providing clean air before entry into box structure, and a holding—cum—hanging means to hold and hang the material being stored and transported.

2. A device as claimed in claim 1, wherein the gas is an inert gas.

3. A device as claimed in claim 1, wherein the outlet for release of gas and clean air is same or different, preferably same.

4. A device as claimed in claim 1, wherein the filtration means is hepa filter.

5. A device as claimed in claim 4, wherein the filtration means is provided on inner side of the top surface of the device.

6. A device as claimed in claim 1, wherein the holding—cum—hanging means consists of horizontal plates connected by vertical means.

7. A device as claimed in claim 6, wherein the horizontal plates are provided with circular means.

8. A device as claimed in claim 7, wherein circular means are optionally provided with clipping means to hold the stored material.

9. A device as claimed in claim 1, wherein the front face acts as door and is capable of opening and closing as and when required.

10. A device as claimed in claim 1, wherein the holding—cum—hanging means is suitable for holding and hanging any material including precursor material, mandrels, hollow soot porous bodies, soot porous bodies and performs or combination thereof.

11. A device as claimed in claim 1, wherein one or more of the mandrel, the hollow soot porous body, the dehydrated and sintered hollow glass body, and the solid glass preform or combination thereof can be stored and transported.

12. A device as claimed in claim 1, wherein the anti-static material is provided on one or more surfaces of the device.

13. A device as claimed in claim 12, wherein the anti-static material is provided on all surfaces of the device.

14. A device as claimed in claim 1, wherein the anti-static material is selected from conventionally available anti-static materials.

15. A device as claimed in claim 1, wherein it is made from a polymer material or a metallic material.

16. A device as claimed in claim 15, wherein it is made from aluminum sheet.

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