

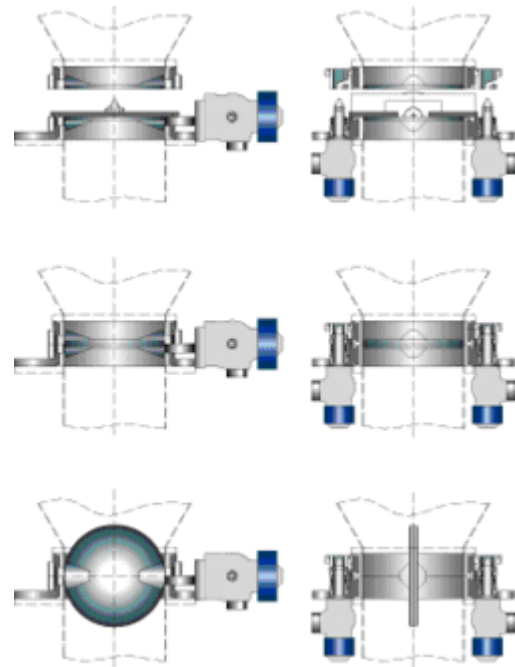
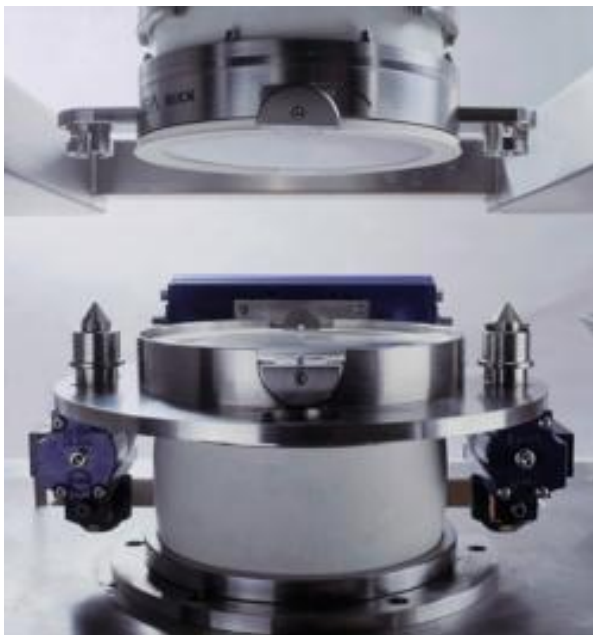
LOADING OF NC7000 USING A BUTTERFLY VALVE SYSTEM

Following the recommendations, based on the precautionary principle, this procedure intends to minimise the potential exposure of workers. With this procedure of containment, the possible exposure of workers to the carbon nanotubes is strongly limited and can be considered as negligible.

The NC7000 are packed in LDPE plastic bags of various sizes. Standard packaging is 2 kg. These bags are closed by a strip or a binder. The **feeding system of carbon nanotubes** is based on the use of a butterfly valve that can be separated in two closed parts (see the scheme hereafter)

The lower part is permanently fixed to the feeder of the extruder. As the bags containing carbon nanotubes are closed in such a way that the distance between the closing bond and the extremity of the bag is large enough to allow its fixation to the butterfly valve, the second part of the valve is fixed with a collar to the bag that contains the carbon nanotubes.

The safety bond closing the bag is then cut. As a safety device does not allow the opening of the valve when the two parts are separated or not correctly linked, the carbon nanotubes can not be in contact with the atmosphere.



The two parts of the valve are then linked together via a device that ensures a hermetic link. The valve is opened and the carbon nanotubes can flow under gravity from the bag to the feeder. When the bag is empty, the valve is closed and the two parts separated. It is impossible to separate the two parts of the valve when it is open.

The empty bag and the part of the valve attached to it are transported into a room where the empty bag is separated from the valve part in a hood. A new bag is then connected with a collar to the valve part and the process can restart. If such a room is not available, a dust extraction system should be installed on the top of the feeder to remove any powder residues that may be liberated during the undocking of the two

valve halves. To avoid emission of carbon nanotubes dusts in the external air, appropriate filter should be placed on the outlet of the air extraction system.

However, as the valve and the bag were in contact to the carbon nanotubes and could possibly be contaminated, **to avoid exposure of workers** by these contaminated surfaces, it is recommended that **they shall wear a mask and gloves** when they separate the bag from the valve and when they install a new bag. Preferably, the operation is done in a hood. These recommendations, based on the precautionary principle, intend to minimise the potential exposure of workers due to the present limited knowledge of the potential hazards of carbon nanotubes.

Adequate protection from airborne carbon nanotubes can be obtained by using a filtering face piece respirator type FFP2 or FFP3. Dermal exposure should be minimized using suitable protective clothing and gloves. In addition, a high standard of personal hygiene after handling carbon nanotubes is recommended.

Procedure

- In the preparation room, extract the bag from its cardboard and fix it with a collar just above the Buck Valve
- Cut the safety bond paying attention in not cutting the bag
- Transport the bag and the passive valve system to the feeder
- Fix the passive system on the active system and open the Butterfly valve.
- When the 2 kg of NC7000 have flown under from the bag to the feeder, shake the bag and close the butterfly valve
- Transport back the empty bag with the passive system to the preparation room
- In the preparation room, separate the empty bag from the valve part
- Under an extraction hood, remove any powder residues, roll the bag, open the collar and withdraw the passive system.
- Store the emptied bags in a large plastic bag that will be closed and that can be incinerated (carbon nanotubes will converted in CO₂ when incinerated).

Recommendations

- **In the Carbon Nanotube (CNT) preparation room (to connect/disconnect plastic bags to top part of butterfly valve):** use of personal protective equipment including (i) disposable protective overall suit covering head, (ii) disposable protective gloves with cuff and (iii) P3 dust respirator masks. The protective suits and gloves have to be changed every day. An appropriate procedure of dressing, undressing and disposal of suits and gloves has to be established. An adhesive mat is placed in front of the CNT preparation room door. The mat is changed after obvious contamination, at least once a week.
- **For transport from/to feeder discharge point to/from CNT preparation room:** top part of butterfly valve is tightly wrapped up in a plastic bag for transport. Plastic bags used are disposed as suits and gloves.

- **After butterfly valve disconnect:** bottom part of butterfly valve is wet-wiped to eliminate possible CNT accumulation between both parts of valve. Wipes are disposed as suits, gloves and transport plastic bags.

Disclaimer

Nanocyl strongly recommends to handle this procedure in accordance with the instructions provided and developed above.

The process and products are intended to be used by persons having developed the skills and knowledge of the described products and compounds, at their own risk. The responsibility of Nanocyl will not be engaged in case of mistreat by any user. No claims based on injury or failure in following instructions will be taken into account.

The User agrees to assume all responsibility to the extent permitted by law for any and all sums which the User and/or Nanocyl become obligated to pay because of bodily injury or property damage caused by or resulting directly or indirectly from the use of the procedure unless it is demonstrated in a legal proceeding that any action, claims and demands are directly based in whole or in part on the default or negligence of Nanocyl.