How to choose the most suitable ferrule for your capillary column

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TECHNICAL NOTES

There are frequent doubts concerning the different materials used to manufacture ferrules for the GC columns. Despite having the same dimensions and the same way of installing, these different materials exhibit unique characteristics that make them suitable for particular applications.

The most used materials are the following:

1. Graphite

Graphite ferrules are made from high-purity graphite, being particularly soft, so they must be handled with care. The main advantages of graphite are that they seal without applying too much force and do not change its shape when subjected to high temperature, therefore there is no need to overtighten the nuts. Since they do not adhere to the column, they can be reused whenever it is disassembled and the column is re-installed, but care must be taken not to deform them by excessive tightening. Graphite ferrules are the most widely used, both in connection of the column to the injector and to the detector, supporting up to 450 ° C. Since graphite is permeable to air, it should not be used in GC-MS systems.

2. Vespel

Vespel is a formulation patented by Dupont consisting of 100% polyimide, a rigid polymeric plastic. Vespel is an excellent solution as a sealant for metal and glass, offering a long lifetime, being also totally impermeable to air, hence it is widely used in GC-MS, while preventing the appearance of baseline noise due to the presence of oxygen. One of the disadvantages of ferrules in Vespel is that they irreversibly adhere to the polyimide that covers the column, not allowing its reuse after disassembly, being necessary to cut a section of the column and use new ferrules. On the other hand, Vespel ferrules tend to shrink after several heating and cooling cycles, so the nuts must be periodically firmly tightened, given the material's hardness. Its maximum operating temperature is 350 ° C.

3. The Vespel / Graphite

The Vespel / Graphite ferrules are made up of mixtures of polyimide and graphite. These are made of mixtures of Dupont polyimide and 15% or 40% graphite by weight, respectively. The inclusion of graphite increases the tolerance to high temperatures and reduces the adhesion to the column lining, as well as its structural alteration (shrinkage). Another advantage is its lower hardness, allowing its reuse and repositioning along the column, as long as they have not been excessively tightened. Being softer than 100% Vespel ferrules, they do not require a very tight grip to seal but are also subject to shrinkage when subjected to heating and cooling cycles, requiring periodic tightening of the nuts. Its maximum operating temperature is 400 ° C. The 60% / 40% mixture is structurally more stable and less permeable to oxygen than the 85% / 15% mixture, both of which are recommended for GC-MS systems.

4. PTFE

PTFE ferrules are made of 100% PTFE, being very soft, chemically inert and exhibits low friction, not adhering to the columns, so therefore reusable. Due to their hydrophobicity, they are used in applications with predominantly aqueous matrices. Its maximum operating temperature is 250 ° C.

TECHNICAL NOTES

Dimensions:

Another important aspect to consider is the dimensions: the internal diameter of the ferrule must correspond to the external diameter of the capillary column, in order to guarantee the tightness of the connection.

In capillary GC, the connections used are 1/16" and the internal diameters (ID) of the ferrules correspond to the following internal diameters of the capillary columns:

Ferrule ID	Column ID
0.4 mm	0.10 - 0.25 mm ID
0.5 mm	0.28 - 0.35 mm ID
0.8 mm	0.45 - 0.53 mm ID

Therefore, if your capillary column has an ID of 0.25mm, the corresponding ferrule should have 0.4mm ID. If it is a 0.53 mm ID megabore column, you should choose a 0.8 mm ID ferrule.

Note that, due to the softness of the graphite ferrules, it is possible to install a column of 0.25 mm ID with a graphite ferrule of 0.5 - and up to 0.8 - mm ID but obviously we do not recommend it.